United States Patent

Henderson

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[54] BALL THROWING AIR GUN

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[51] **Int. Cl.** **F41b 11/00**

[58] **Field of Search** .... 124/30, 11, 30 R; 273/26 D, 273/28

[56] **References Cited**

UNITED STATES PATENTS

884,024	4/1908	Lake	124/11
1,266,764	5/1918	Blair	124/30 R
2,526,018	10/1950	Foster et al.	124/11
3,467,073	9/1969	Rhodes	124/11
1,379,403	5/1921	Green	124/30

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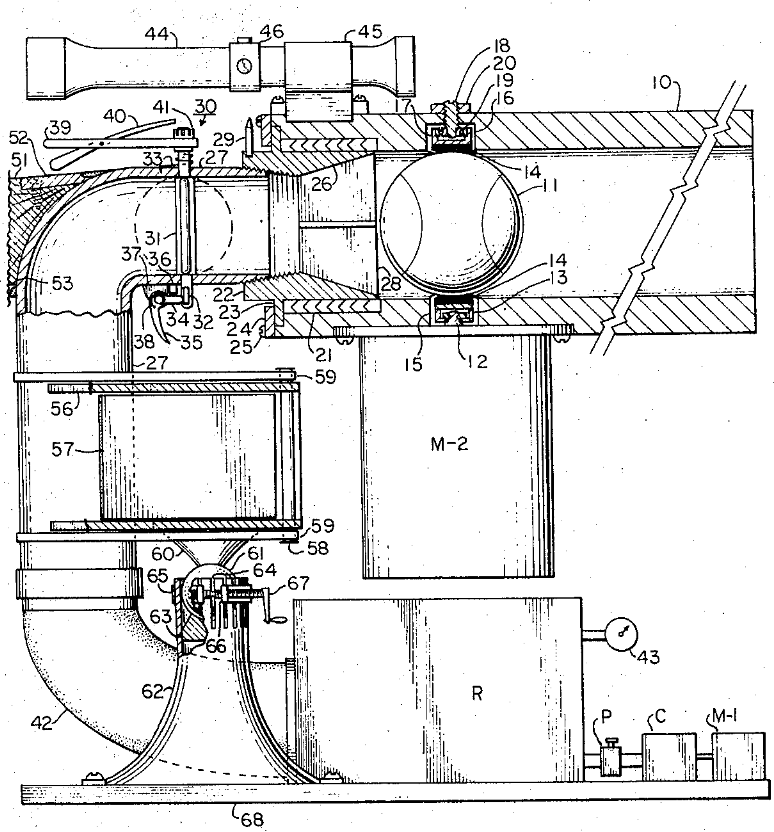
[57] **ABSTRACT**

A ball is propelled from a gun barrel by compressed gas, normally air. The air is stored in a reservoir at a selected pressure to give to the ball the desired muzzle velocity. A quick acting valve is opened to admit the reservoir stored air into the barrel to propel the ball. The device is equipped to spin the ball if one wishes to simulate pitched curves, such as is used in the game of baseball. A speed-controlled motor is mounted on the breech of the gun barrel and engages the chambered ball. When a curve is desired the motor is energized to spin the ball at any desired spin speed so that the ball has this spin speed when the valve is opened to project the ball. The barrel is rotatable so that the operator can orient the axis of the ball spin.

2 Claims, 4 Drawing Figures



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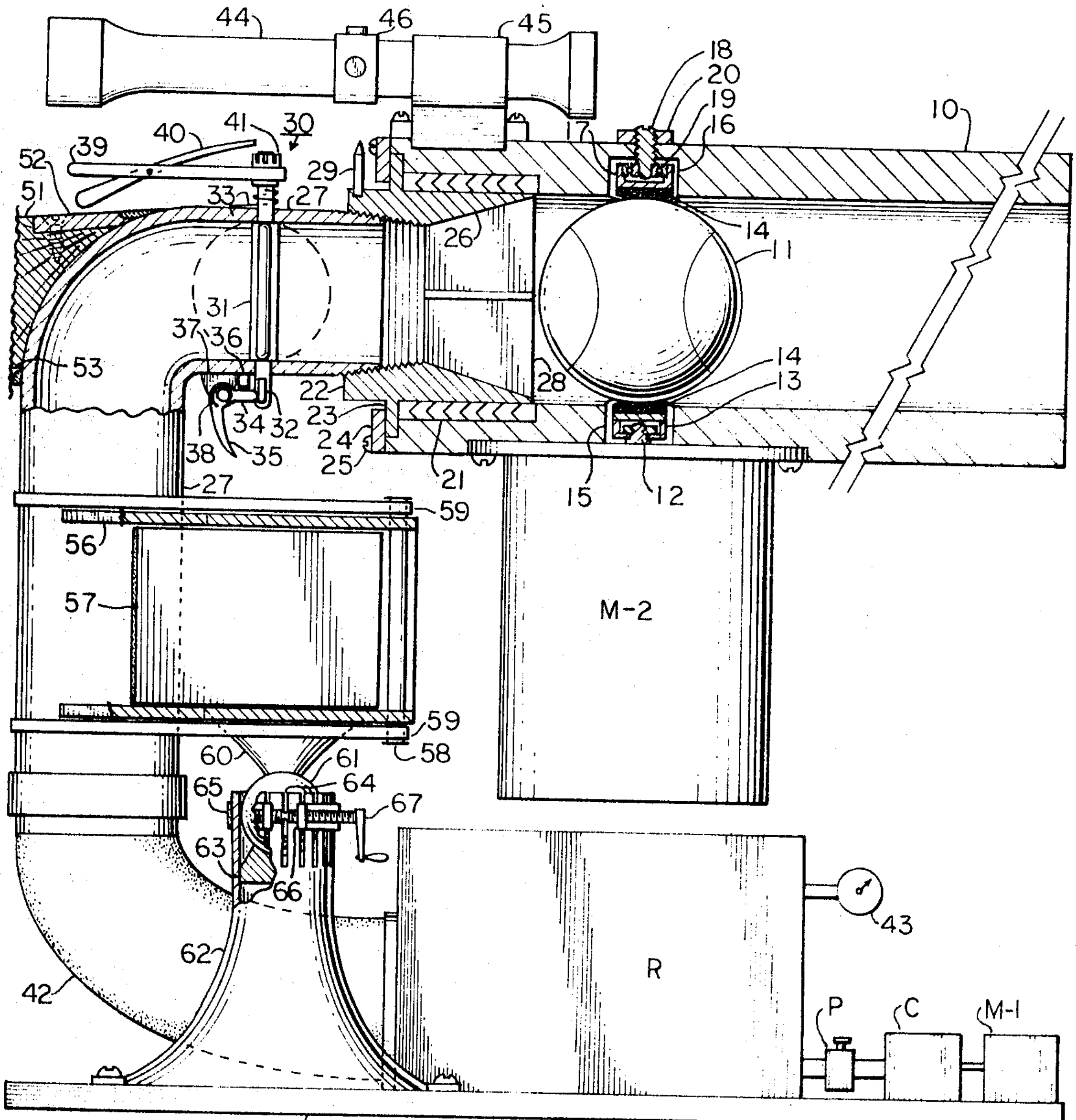

FIG. 1

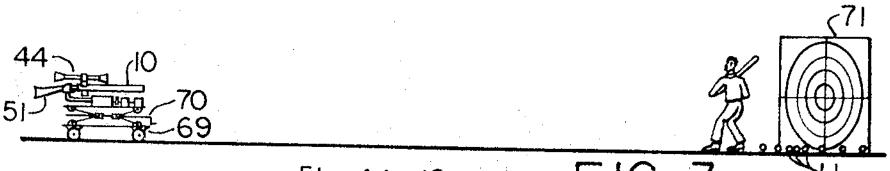

FIG. 3

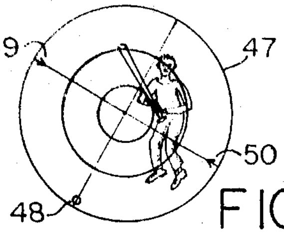

FIG. 2

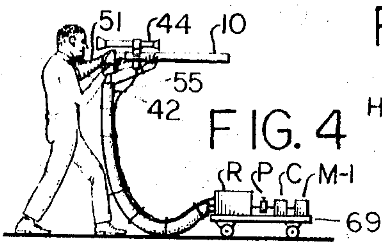

FIG. 4

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BALL THROWING AIR GUN

DESCRIPTION

This invention pertains to that class of devices designed to throw balls, any balls, but especially baseballs, and more specifically that subclass designed for training baseball players. The device is useful for other purposes, wherever an accurately thrown ball is desired, with the ball having a spin, or no spin.

In training baseball players coaches find it highly desirable to have a device that can accurately throw, and accurately duplicate the characteristics of those balls thrown, or batted, which the players will experience when playing the game. Several such devices have been built heretofore but each has been deficient in one or several respects: (1) inaccuracy of throw; (2) inability to throw characteristic curves; (3) incapable of selective ball speeds from the slowest to the highest speeds experienced in baseball; (4) inability to throw a non-rotating ball, "knuckleball."

It is therefore one object of this invention to provide a ball thrower that is most accurate in hitting intended targets, and utilizes a magnifying scope sight to better observe the flight of the ball and the action of players.

Another object of this invention is to provide a ball thrower that can throw a spinning ball, spinning around any desired axis that is at right angles to its line of flight, and thereby duplicate any Pitcher thrown curve, or any spinning batted ball.

Another object of this invention is to provide a ball thrower that can duplicate any ball speed, from the slowest to the highest that are experienced in baseball, whether thrown or batted.

Still another object is to provide a ball thrower that can throw a non-rotating ball, "knuckleball."

A further object is to provide a mechanical ball thrower that is simple in operation, and is economical to make and to use.

These objects and other more detailed objects hereinafter appearing are attained by the device illustrated in the accompanying drawings in which:

FIG. 1 is an elevational view of the device with a few of the parts shown in section for clarity purposes.

FIG. 2 is a scope-sight view as seen by the operator of the device when training Batters.

FIG. 3 is a schematic elevational view of the device, mounted on an elevating truck, and being used for Batter training.

FIG. 4 is a schematic elevational view of the device when used as a hand-held gun to throw to batters, or fielders.

One essential requirement of a successful ball thrower is the ability to throw curves. A curve is thrown by a pitcher when he gives the thrown ball a spin about some axis at right angles to the line of flight. The reason for the curve is explained by Bernoulli's law of fluid flow: $P + V^2/2 + wz = a$ constant, and in a closed system : $P_1 + \rho V_1^2/2 + wz_1 = P_2 + \rho V_2^2/2 + wz_2$; where P is the pressure head; V is the velocity head, (ρ is mass density of fluid and V is the velocity); and wz is the elevational head, (w is the specific weight of the fluid, and z is the elevation relative to a datum plane) ; and all in pressure units. In the case of a spinning ball in flight, only the pressure difference on the opposite sides of the ball is under consideration, since the elevational heads are the same on both sides of the ball. Assume that an observor is looking down on a thrown ball that is traveling away from him and to the observor the ball is spinning clockwise around a vertical axis and is traveling horizontally. Assume that the ball's translational speed is V and that the peripheral velocity of the ball's surface due to its rotation is v . Since friction carries a thin surface of air with the rotating surface, the actual velocity of the air on the left side of the ball is the resultant of the two velocities ($V - v$), and the actual velocity on the right side of the ball is (V + v). Therefore:

$$P_l + \rho \frac{(V-v)^2}{2} = P_r + \rho \frac{(V+v)^2}{2}$$

where P_l is on the left side and P_r is on the right side. Hence,

$$\Delta P = P_l - P_r = \frac{\rho}{2}\left[(V+v)^2 - (V-v)^2\right].$$

It is the ΔP that causes the ball to accelerate at right angles to the line of flight, and in the direction of the higher resultant velocity, i.e. (V + v), and in this instance to the right. It is noted that the ΔP is proportional to the sum and difference between V and v , rather than to either's individual magnitude. When v is a small percent of V the effect is quite small, but increases rapidly as v becomes an appreciable percent of V . In this assumed case with a ball rotating clockwise, the resultant trajectory is deflected into a clockwise trajectory , or curve, as seen by the observor. Had the ball rotated counterclockwise, then the trajectory would have deflected into a counterclockwise curve. Had the ball been thrown with a spin on a horizontal axis, perpendicular to the line of flight, then again the observor would have seen a clockwise curve when the ball had clockwise rotation; and he would have seen a counterclockwise curve when the ball had counterclockwise rotation, when viewed in elevation.

Professional pitchers are capable of rotating their pitched balls with rotation axes from horizontal to vertical. This invention is capable of rotating the thrown ball around any axis that is at right angles to the initial trajectory. In this invention the ball is blown from a gun barrel by compressed air, or other gas, and the muzzle velocity can be varied from the slowest practical pitch to the fastest pitch achieved by professional pitchers, or batters, simply by varying the air pressure. The speed of rotation given to the ball can vary from zero to values much higher than any achieved by pitchers. Consequently, any type of pitched or batted ball can be duplicated by this device. Any difficult-to-hit pitch can be repeatedly thrown to batters, and any difficult-to-catch ball can be thrown to fielders. FIG. 1 shows the gun barrel **10** in longitudinal section, with a ball **11** within the bore and in place for throwing. A small motor M–**2** is mounted on a flat, milled on the gun barrel, and it is further adapted to rotate the ball prior to throwing. This motor is a variable speed, reversible motor. It is preferably an electric motor, but a fluid motor may be used. The motor shaft **12** carries a ball-rotating pad **13**. This pad projects through a hole **15** in the wall of the barrel **10**. On the interior end of the pad is a compressible cushion **14**, concave to fit the ball **11**. This cushion **14** may be made of foamed polyurethane, or similar material, it is molded or formed to fit the ball and to hold the ball in-place for throwing, and to provide the frictional force required to rotate the ball as the shaft **12** rotates.

Diametrically opposite the hole **15**, and colinear with it and the motor shaft **12** is a second hole in the gun barrel wall, hole **16**. The inner end of hole **16** is large enough to accomodate a rotated-pad **17**, similar to rotating-pad **13**. Pad **17** also carries a friction-producing, compressible, concave cushion **14**, which engages the ball opposite from pad **13**. The outer portion of hole **16** is smaller than the inner portion and it is threaded to accomodate a threaded arbor **18**. On the inner end of the arbor **18**, is pressed the ball bearing **19** and the rotated-pad **17** is pressed over the outer surface of the bearing **19**. This assembly of arbor **18**, and bearing **19**, and rotated-pad **17**, is inserted in the hole **16** from the inside of the gun barrel and the arbor **18** is screwed into the threaded portion of the hole **16** with a screw driver engaging the slot in the outer end of the arbor **18**. The threaded portion of the arbor **18** permits a fine adjustment of the arbor **18**, to achieve the desired compression force on the ball **11**. When the desired adjustment is achieved the arbor is locked in adjustment by the locking nut **20**.

The rear end of the gun barrel **10** is recessed to receive the seal packing **21**. The breech ring **22** is adapted to sealingly fit the packing **21**. The breech ring has an annular extension **23** to rotatably fit in a recess in the end of the gun barrel. A retaining ring **24** is secured by screws **25**, to the end of the gun barrel, and holds the breech ring rotatably in place. The rear end of the breech ring **22** is threaded to receive the pipe **27**, while the forward end is flared as at **26**, and is provided with multiple flowastraightening vanes **28** to assure a smooth flow of air to the ball **11**. The forward ends of the vanes **28** provide a stop for the ball **11**. To load the ball, it is inserted into the muzzle of the barrel and manually pushed inward with a ram rod until the ball contacts the vanes **28**. The concave cushions of the pads **13** and **17** compress and grip the ball **11** and center it in the cushions **14**, thereby moving it slightly forward of the vanes **28** so that there is no contact with the vanes when the ball is rotating.

The breech ring **22** is secured against rotation relative to the pipe **27** by the threaded engagement. The thread engagement may be cemented to assure no rotation. The barrel **10** may be rotated relative to the breech ring, with slippage occuring at the seal packing **21**. This packing is compressed sufficiently by the ring **24** to provide eneough friction to hold the barrel **10**, with the motor **M–2**, in any desired position while still permitting Operator adjustment of ball rotation plane. To facilitate the throwing of any given ball curve, the ring **24** is preferably calibrated in degrees from the index pin **29**, which pin protudes from the breech ring **22**.

Compressed air, or other gas, is admitted into the barrel **10**, through the pipe **27**, which pipe should be large eneough to pass the required amount of gas in a very short time and with a very low friction loss, normally a 2-inch pipe. The pipe **27** has a trigger valve **30**, which valve may be any full-opening valve, such as the butterfly valve shown, or a ball valve. The valve disk is shown by solid lines in the closed position, and by dashed lines in the open position, or phantom. The upper end of the valve spindle **31**, has a spring **33** sufficiently strong as to quickly open the valve to full open position, (hence motorized) upon release of the trigger **35**. The lower end of spindle **31** carries a stud **32** that rests against the trigger sear **34** when the valve is closed, holding the valve in closed position until the trigger **35** is squeezed. Upon squeezing the trigger the strong spring **33** causes the valve disk to quickly fly to the full open position, at which point it contacts the stop **36**. The trigger **35** is pivotally mounted upon the bracket **37**, and the spring **38** biases the trigger forward. The upper end of the valve spindle **31** has an operating handle **39**, which handle is free to rotate on said spindle. Securely mounted on the upper end of the spindle, and above the handle **39**, is a notched cap **41**. The operating handle **39** has a pivoted latch **40**, that engages the notches in cap **41**, only when the outer end of the handle is gripped. The operator can grip the handle and close the valve **30**, whereupon the valve is held in the closed position by the trigger sear. It is seen that the valve disk can fly to the open position without rotating the high inertia handle **39**, upon trigger release. The latch **40** may be held in the unlatched position by making the outer end heavier than the inner end, as shown, or by spring means.

Immediately upstream of the valve **30** the pipe **27** turns sharply downward and terminates with a length of flexible tubing **42**, highly flexible convoluted tubing is preferred. The tubing **42** connects to the air receiver R. The total volume of the pipe **27**, tubing **42**, and receiver R, upstream from the valve **30**, is preferably one or more volumes greater than the volume of the gun barrel **10**, to permit the use of lower air pressure for a given ball velocity. The gun barrel may be 2 or 3 feet in length with an inside diameter of 3 inches. Should this upstream volume be the same as the volume of the gun barrel **10**, and the prefiring pressure is P , then the total volume of air when the ball is at the muzzle has doubled, and the air pressure has been reduced to $P/2$. The effective pressure in regards to ball acceleration is : $(P + P/2)½ = ¾\ P$. The greater this upstream volume the lower the pressure decrease at ball exit from the muzzle, but the greater the amount of compressed gas required. A compromise is necessary, and an upstream volume equal to the barrel volume is a reasonable one.

The air compressor C is preferably a vane type compressor since the pressure required is low - a pressure of 10.8 psi. gives a ball velocity of 150 feet/sec., which is higher than the reported maximum velocities of the fast-ball Pitchers.

The motor **M–1** is preferably an electric motor since most training fields have electric power available, and an extension cord can be run to the motors.

The pressure regulator P is a conventional air compressor regulator for electric powered compressors, wherein the pressure desired is set into the regulator and the regulator causes a closed electric circuit to the motor so long as the receiver pressure is less than the set pressure, and opens the electric circuit when the receiver pressure reaches the set pressure value. Since the ball velocity is proportional to the air pressure, this regulator *P* may be calibrated in ball velocity units as well as in pressure units. The Operator can quickly set his regulator for any ball velocity desired. As a safeguard this regulator should have a positive lock to prevent excessively high pressures that would result in dangerously high ball velocities.

The pressure gauge **43** should be visible to the operator,and it should have a large face so that he can quickly see that he has the pressure necessary for the velocity he desires. This gauge should also have velocity calibration. For safety, the receiver may incorporate a safety relief valve.

The motor **M–2** is used when it is desired to throw a curve. This motor is preferably electric, reversible, and with a speed control, all conventional. The speed control should be calibrated in revolutions per second, and if the control is not reliable in duplicating the "set" speed, then a conventional tachometer should be used to indicate the speed of this motor, as it is necessary to know this if specific curves are to be thrown. A chart of test results can be supplied the operator to indicate the required motor speed to give the required curve, at any given ball velocity.

A right hand ball pitcher curves the ball to his left, while a left hand Pitcher curves the ball to his right. As a consequence the operator must reverse the motor **M–2** when changing from right hand pitches to left hand pitches, in his simulation curves. To assure that a spinning ball does not have its rotational speed slowed unduly during transit in the barrel **10**, the bore of the barrel is slightly larger than the ball to give clearance for the ball. The blow-by due to this slight clearance is compensated by a higher initial air pressure, and/or volume. The wall of the barrel bore is preferably coated with a low friction coating, such as Dow Corning's "Molykote 321 Bonded Coating" or with Teflon, or similar coating. This coating reduces friction and ball wear. Baseballs should be graded as to size with a "go" — "no go" gauge to assure uniformity of performance.

To indicate the aproximate values involved, and the physics involved, assume: a ball 9¼inches in circumference; weighing 5¼oz.; and that the gun barrel is 2 feet long; and the air volume upstream of the trigger valve is equal to the volume of the barrel's bore . That the pressure upstream is $P = 10$ psi.; sectional area of the ball - $A = 6.7$ sq. in.; the mass of the ball, $M = 0.01$ slugs; $F =$ force in pounds; $a =$ acceleration in ft/sec.^{2} ; $t =$ time in seconds; length of gun barrel, $s = 2$ feet; $V =$ velocity of the ball in feet/sec. With the initial pressure at 10 psi., by the time that the ball has reached the muzzle the air volume has doubled and the barrel pressure has reduced to $P/2 = 5$psi., for an average pressure of 7.5 psi. The average force: $F = AP = 6.7 \times 50.2$ lbs. The acceleration: $a = F/M = 50.2/0.01 = 5{,}020$ ft/sec^2. For time of muzzle travel: $t^2 = 2s/a = 2(2)/\ 5{,}020 = 0.00798$; and $t = 0.028$ sec. The ball velocity: $V = at = 5020(0.028) = 141$ ft/sec. , which is approximately the maximum speed of ball pitchers. It is noted that the time that the ball is being accelerated in the barrel is only 28 milliseconds, not long eneough for appreciable ball rotation decelleration.

For accuracy it is desirable to have a sight on this ball-gun and a a conventional rifle scope sight **44**, is preferred. This scope sight can be mounted on the gun barrel in a conventional manner using the mounting fitting **45**, as shown. The conventional windage and elevation adjustments **46**, are desirable to "sight-in" the gun at various air pressures and ball rotation speeds. It is desirable to modify the sight's reticle, as shown in FIG. **2**, wherein the operator is throwing left-hand pitches to a Batter. On this reticle the small circle **48** indicates to the operator the location of the motor M–2. When pitching left hand curves the motor M–2 should be turning clockwise when viewed from above and behind the gun. When simulating a horizontal curve the motor should be directly on bottom with its reticle line vertical. When simulating a dropping curve, the motor, circle **48**, should be moved to the left of center when throwing left hand curves. On the reticle the arrow **49** indicates the direction of ball curve when the motor turns clockwise, and the arrow **50** indicates the direction of ball curve with the motor turning counterclockwise (viewed from above). With this reticle, and this accurate gun, the operator can throw that particular pitch that the batter has difficulty in hitting, and throw it time after time in that particular zone that is most troublesome for the Batter. Variations in ball speed, degree of curve, and ball placement are readily achieved. When throwing right hand curves the motor M–2 should turn counterclockwise, and if some drop is desired in the curve the motor M–2 should be at right of center, reticle-wise.

The momentum of a ball leaving the gun barrel at 141 ft/sec. is: MV = 0.01 (141) = 1.41 slug-ft/sec. This is approximately 80 percent of the momentum of the U.S.A. caliber 30 — '06 rifle. Since the gun has the same momentum (in reverse direction), it is apparent that the ball gun of this invention can be operated as a hand-held gun, with the stock **51** held against the operator's shoulder in a conventional gun manner, as shown in FIG. **4**. This is the preferred method for training fielders, the operator can quickly change his ball placement, gun elevation, etc. , especially on grounders; the operator can throw grounders with back-spin, or over-spin, and other variations of spin and curve. He can throw in practice, excessively fast balls to over-train on fielding "hot" grounders. The hand-held gun is excellent in training fielders in fly catching, since the practice ball can be thrown high, or as a very fast line drive, and accurately placed so as to extend the fielder in reaching the ball, as well as in judging its trajectory. The stock **51** is held by screws between the lugs **52** and **53**, of FIG. **1**. In the hand held model the flexible hose **42** is made long eneough to permit operator maneuvering without disturbing carriage **69**. If the hose **42** is sufficiently long to supply the needed upstream volume, one can dispense with the receiver R, to economize on compressed air. FIG. **4** shows the electric cable **55**, conducting power to the motor M—2.

When simulating a particular pitch that batters find hard to hit, it is preferable to have a semi-permanent fix to the ball gun so that this pitch can be thrown innumerable times until the batter, or batters, learn to hit it. In this case the carriage mount of FIG. **3** is preferable.

Referring now to FIG. **1**, there is shown a square tubing **57** welded to the pipe **27**. A second square tubing **56**, just slightly larger than the tubing **57**, to permit a sliding fit when placed over, is shown in place, with the forward face removed in section in the drawing to better show the relationship of the two tubings. The larger tubing **56** has its inner end cut to a vee to embrace the pipe **27**. The outer end of the larger tubing **56** is drilled to receive a rod **58**, which rod projects above and below the tubing **56** to receive upper and lower shock cords **59**. The two stretched rubber shock cords hold the pipe **27** firmly in the vee of the tube **56**. These shock cords may be "-bungee" cords as used in the aircraft industry. Welded to the lower face of the larger tubing **56** is an inverted pedestal **60**, ending in a ball **61**. The ball **61** fits snugly in the top of an upright pedestal **62**. The upright pedestal has a concave seat **63** to support the ball **61**. The upper section of the pedestal **62** has numerous slots **64**, to permit easy deflection thereof. Around the upper slotted portion of the pedestal **62** is a flexible steel band **65**, having lugs **66** on the ends thereof. These two lugs are drilled and tapped, one left-hand and the other right-hand thread to accomodate the left hand-right hand screw and crank **67**. The crank screw **67** tightens the bank **65** to clamp the ball **61** in any adjusted position. The weight of the total assembly is supported by the base **68**. The weight of the gun assembly: gun, pipe **27**, and flexible tubing **42** is supported by the pedestal **62**, via the ball seat **63**, ball **61**, pedestal **60**, large tubing **56** and small tubing **57**. Due to the sliding fit between the two tubings **56** and **57**, the pipe **27** is capable of lateral movement relative to the pedestal **62**, subject to the restraint of the shock cords **59**. The recoil of the gun is absorbed as heat in the rubber shocks **59**, and the heat of friction between the tubings **56** and **57**. To sight the gun the Operator loosens slightly the crank screw **67**, then with the gun's weight supported on the ball seat **63**, he easily manipulates the gun until the scope sight **44** is "on target" whereupon he securely clamps it in place by tightening the crank screw **67**. The gun is then ready to fire as many shots as desired.

The carriage **69** of FIG. **3** may have an elevating device such as the jackscrew **70**, or other means such as hydraulic cylinders, to adjust the height of the gun to simulate height of pitcher ball release :- under-hand, side-arm, or over-hand. Behind the batter in FIG. **3** is a back stop **71**. This back stop may have a layer of foamed plastic on its front face to act as an energy absorber and to protect the balls, and reduce rebound. The plastic may be foamed polyurethane. It is preferable to have the front face of this back stop of a dark color so that the operator can better follow the flight of his white ball, and the batter's white bat, as seen in his magnifying scope sight. By putting a "bull's eye" directly behind home plate, on the back stop, facilitates sighting in the ball gun, and adjusting the windage and elevation adjustments of his scope sight for various curve pitches, to assure accurate ball placement.

The coach, by watching through the magnifying scope sight, can tell the batter, after each pitch, just what he is doing wrongly, and to what extent:- swing high or low, late or early, chopping up or down, if he keeps his eye on the ball, and if he follows through properly. This is an excellent evaluation, heretofore largely impossible to evaluate accurately. Also, it is excellent for batters (and pitchers) to spend considerable time observing other batters in practice with this invention, observing through the scope sight to analyze the timing and swing of good batters, and poor batters.

Thus it is seen that Applicant has produced a device that has definite and positive control of the ball's flight, i.e. the ball's velocity — determined by air pressure — and the curvature of flight, determined by the speed of the motor M—2 and the orientation of its axis. This positive and precise control has been lacking in the many previous devices in this field. Applicant's spring powered trigger valve **30**, assures a fast opening valve with a short constant opening time. Previous devices have used manually opened valves wherein the time of opening varied considerably, and consequently the ball's velocity — since the time of in-barrel travel is so short (0.028 sec.) any slight variation in valve opening time will greatly affect the ball's velocity.

In applicant's device the ball is given the desired rotational speed and axis orientation prior to firing. The devices of the previous art depended upon friction surfaces located in segments along the barrel's inner face to contact a small segment of the ball as it was in transit in the barrel thus causing rotation due to frictional forces developed on the ball by these friction strips. However the time of ball travel in the barrel being so short (0.028 sec.) large forces are required to sufficiently accelerate the rotation of the ball in such a short time. The forces required are so high as to cause damage to the ball's surfaces, consequently, the required speed of rotation was not achieved. The amount of rotation that was achieved, varied considerably, varying with:-speed of translation of the ball, size of the ball, condition of the ball's surface (wet, dry, glazed, fuzzy, muddy, seam location, etc.); as well as with the condition of the friction surface itself (resilience, wet or dry, new or worn, dirtiness, etc.).

I claim:

1. In a pneumatic ball projector having an aimable rotatable gun barrel to chamber a ball,

having a reservoir to store compressed air at a selected pressure, having valve means to suddenly admit reservoir-stored air into the breech of said barrel to project the ball from said barrel,

the improvement for giving to the projected ball a preselected spin velocity around a spin axis having a preselected orientation, said improvement comprising:

a speed-controlled motor means, a ball-supporting means mounted on the breech of said rotatable gun barrel, said ball supporting means comprising a plurality of devices for engaging a ball at symmetrically spaced points about its periphery and supporting the engaged ball for spinning about a spin axis which is fixed with respect to said gun barrel, at least one of said devices being a compressible cushion for frictionally engaging a ball, said cushion being operatively connected to said motor means to be rotated thereby, said ball-supporting means imparting a spin to the ball while holding the ball in in said breech prior to operation of said valve means to admit air into said breech to project the ball, power means to energize the speed-controlled motor means prior to ball projection to spin said ball within said breech at a selected speed, and means to rotate said gun barrel to thereby rotate said ball-supporting means to give the spin axis of said spinning ball the orientation desired to ensure that the projected ball will have the desired trajectory.

2. The pneumatic ball projector defined by claim **1**, including:

Sight mounting means mounting a telescopic sight on said ball projector,

said sight having a reticle comprising: one reticle wire at a fixed orientation with respect to the said spin axis of said spinning ball which is fixed with respect to said rotatable barrel, and having at least one reticle wire in the form of a circle and concentric with the field of view to permit radial distance measurements,

said sight mounting means having means to rotate said sight reticle in synchronism with said rotatable gun barrel.

* * * * *