

[54] **TENNIS BALL PROPELLING MACHINE**

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[58] Field of Search **124/1, 49, 48, 50, 124/41, 34, 30 R; 273/26 D; 222/216; 74/230.17 C; 56/DIG. 15**

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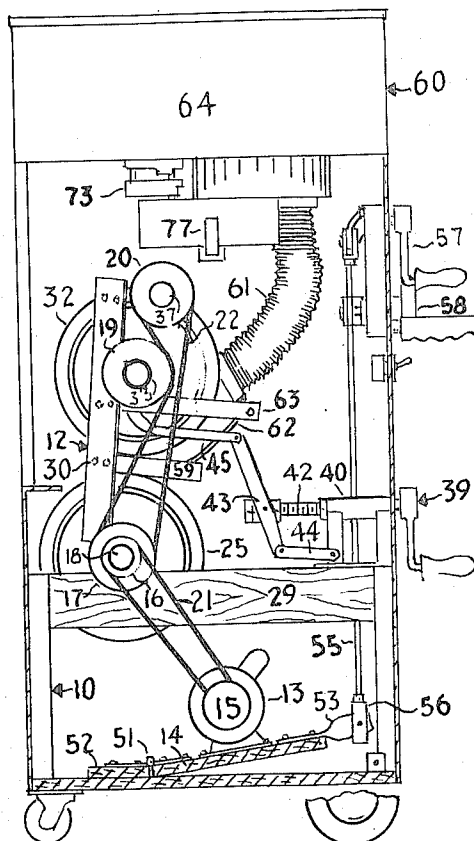
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[57]

ABSTRACT

A device employing motor driven variable speed drive means rotating two spaced propelling wheels rotating in opposite direction. Balls are fed into the ball propelling wheel assembly through a hopper incorporating an agitating carousel with an auxiliary ball agitator. A speed drive with a split drive pulley varies the rate of rotation of the carousel and the rate of delivery of the tennis balls through a tube to a ball feed guide, first positioning the balls in contact with the upper ball propelling wheel then into the ball propelling space. The angle of projection is regulated by adjustably varying the angle of the ball wheel arm. The device is normally electric powered incorporating remote control cables, a wheel mounted cabinet is desirable for mobility.

8 Claims, 5 Drawing Figures



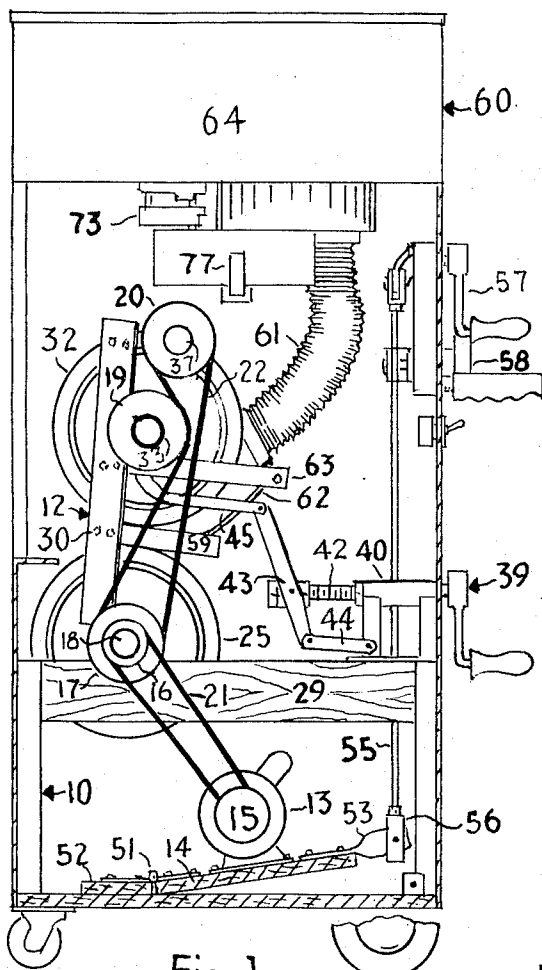


Fig. 1

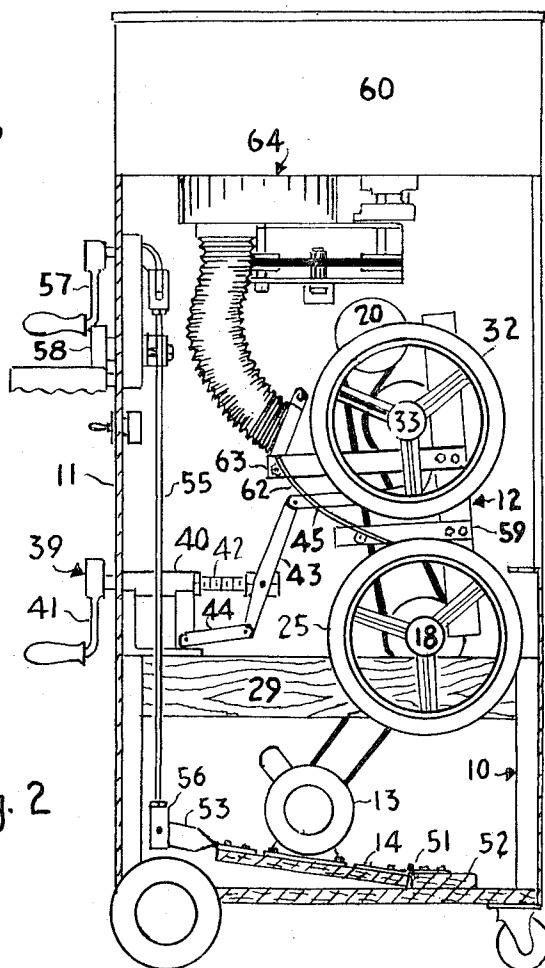


Fig. 2

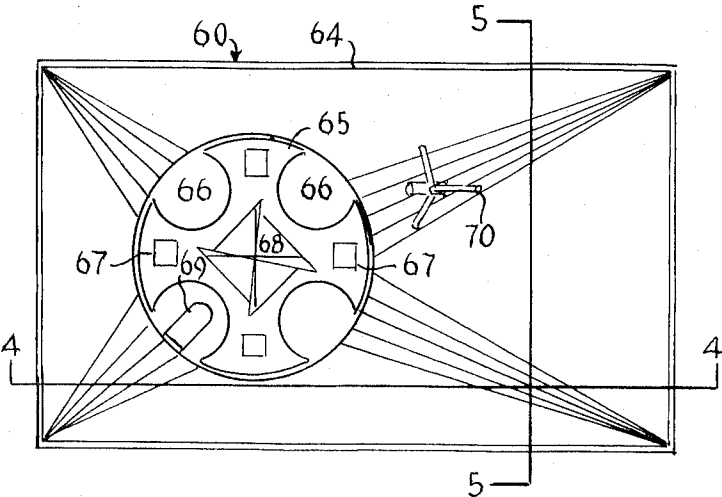


Fig. 3

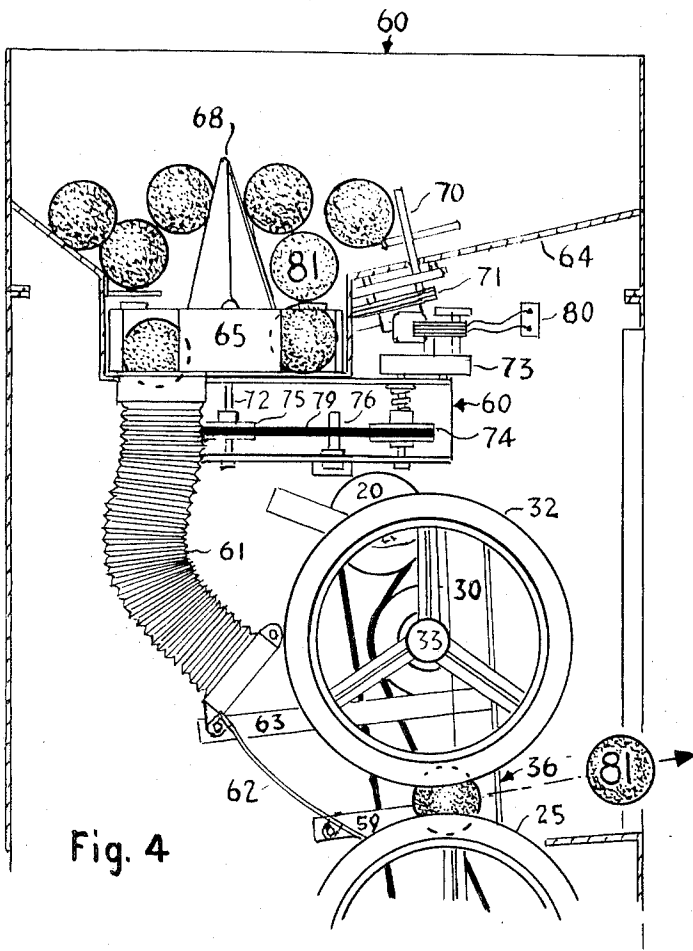


Fig. 4

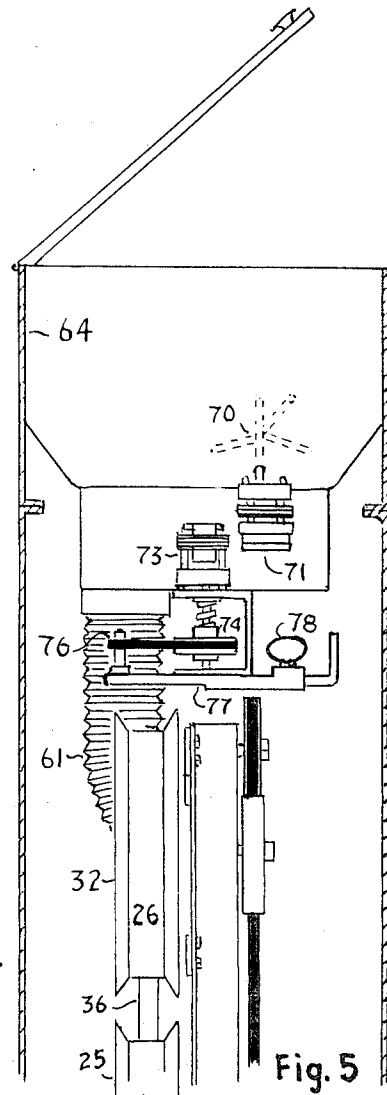


Fig. 5

TENNIS BALL PROPELLING MACHINE

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention pertains to the art of propelling or projecting tennis balls by positioning them between two closely spaced opposite rotating wheels and frictionally projecting the balls at the tangent of the rotating wheels. The device is capable of being modified to project other types of balls such as baseballs.

2. Description of the Prior Art

Numerous devices have been invented and patented pertaining to the art of projecting or propelling baseballs and tennis balls for player practice. Throwing arms, striking means, and propelling wheels have previously been utilized. U.S. Pat. Nos. 1,204,468, 2,729,206, 2,918,915 and 3,399,660 are typical of the art.

SUMMARY OF THE INVENTION

In the art of mechanical tennis ball projecting means, it is highly desirable to impart an overspin to the ball to simulate the natural spin to the ball imparted by a forehand or backhand drive by a player. It is also necessary to vary the angle of trajectory or degree of loft of the ball. The rate and speed of delivery should also be controllable by adjustments integral in the projecting device. In the concept and development of the device of this invention, many objects and purposes were accomplished among which was the imparting of overspin on the projected ball. This has been accomplished by first positioning the ball in the ball feed guide in contact with the upper ball propelling wheel prior to contacting of the lower ball propelling wheel and projecting of the ball through the ball propelling space. The angle of trajectory is controlled by tilting the ball wheel arm on which the propelling wheels are mounted for rotation. This tilting varies the tangential angle of the two wheels comprising two parallel lines defining the ball propelling space. Adjustable variable speed drives vary the rate of rotation of the two propelling wheels. Bridging or arching of the balls in the feed hopper is eliminated by agitation cams, the carousel pyramid, and the auxiliary agitator which are components of the ball feed mechanism. The rate of delivery of the balls to the ball propelling wheel assembly is accomplished through adjustable means in the feed belt drive regulating the rate of rotation of the ball carousel. The combination of the device results in controlled delivery with a rate of drive and degree of lob simulating an expert opponent.

For a more detailed description of the construction and operation of the preferred embodiment, reference is made to the attached several views wherein identical reference characters will be utilized to refer to identical or equivalent components throughout the various views and the detailed description of the preferred embodiment.

FIG. 1 is a left side view of the device with a portion of the cabinet fragmented for clarity of view.

FIG. 2 is a right side view of the device with reference to FIG. 1 with a portion of the cabinet fragmented for clarity of view.

FIG. 3 is a top view of the device disclosing primarily the interior of the ball hopper and that portion of the feed mechanism, comprising the carousel ball agitator.

FIG. 4 is a slightly enlarged, fragmented sectional view of the device taken substantially on line 4—4 of FIG. 3 looking in the direction of the arrows.

FIG. 5 is a fragmented, sectionalized view taken substantially on line 5—5 of FIG. 3 looking in the direction of the arrows and illustrates a view of the machine from the position of the player.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a description of the method of construction and use of the preferred embodiment, reference is made to the various views. The device was constructed on a mounting frame 10 on which all of the propelling components were mounted. The device is enclosed in a cabinet 11. The ball propelling wheel assembly 12 is powered by a drive motor 13 which is secured to a motor mounting board 14. Drive motor 13 had mounted on its output shaft a 3 1/2 inch spring loaded variable velocity split pulley 15. Driving force through "V" belt drive means is imparted next to a 3 inch outer "V" belt drive pulley 16 and in turn to an inner 5 inch "V" belt pulley 17 which are mounted side by side on the lower ball wheel drive shaft 18. With specific reference to FIG. 1 following the drive means a 4 1/2 inch diameter upper ball wheel flat drive pulley 19 contacts the upper "V" belt 22. The belt proceeds around the flat drive pulley 19 to idler pulley 20 which retains and secures it in position and in contact with flat drive pulley 19. The feed belt drive means for the ball propelling wheel assembly 12 comprises a motor drive belt 21 which interconnects variable velocity split pulley 15 and outer pulley 16. The 5 inch diameter inner belt pulley 17 is connected to idler pulley 20 by upper "V" belt 22 whose outer surface contacts and drives upper ball wheel flat drive pulley 19. The lower ball propelling wheel 25 is secured to lower ball wheel drive shaft 18 adjacent the outer 16 and inner 17 "V" belt pulleys. The ball propelling wheels 25 and 32 should have an outside diameter of eleven inches with a diameter of ten inches in the ball channel 26. The shaft for the lower ball propelling wheel 25 is mounted in a ball bearing mounting bracket (not shown) which is secured to mounting cross arm 29. The lower ball propelling wheel 25 and upper ball propelling wheel 32 are maintained on a common axis and secured in relative position by ball wheel arm 30 which is hingedly secured to mounting frame cross arm 29. The upper ball wheel shaft 33 and lower ball wheel shaft 18 are rotatably mounted in ball bearing bracket means (not shown) secured to the ball wheel arm 30. Idler pulley shaft 37 is likewise rotatably mounted on ball wheel arm 30 above the upper ball wheel shaft 33 in suitable bearing means.

Adjustable means are provided to vary the relative position of lower ball propelling wheel 25 and the upper ball propelling wheel 32. A tilting of the ball wheel arm 30 varying the tangential angle of the closest point of contact of wheel 25 and 32 and determines the angle of the ball propelling space 36. This elevation control means 39 comprises an elevation control mounting bracket 40 which is secured to mounting frame cross arm 29 adjacent cabinet 11. A turning of angle adjusting crank 41 drives angle adjusting screw 42 on which is threadably mounted angle adjusting swivel 43. This swivel 43 is connected at its lower extremity to lower connecting link 44 which is pivotally attached to elevation control mounting bracket 40. The

upper connecting link 45 interconnects elevation control means 39 to ball wheel arm 30. A turning of angle adjusting crank 41 moves angle adjusting swivel 43 resulting in a tilting of ball wheel arm 30 varying the angle of tangential projection of ball propelling space 36.

The rate of rotation of ball propelling wheel assembly 12 is varied by the relative distance between variable velocities split pulley 15 and outer belt pulley 16. To accomplish this adjustment motor mounting board 14 is tiltably secured to a pivot hinge 51 which in turn is fixedly attached to mounting frame 10 by pivot hinge bracket 52. Attached to the opposite end of motor mounting board 14 is motor board arm 53. This arm is pivotally attached to motor lift rod 55 by means of pivot 56. A motor lift crank 57 is operably attached to the opposite end of motor lift rod 55. A rotation of crank 57 will lift or depress drive motor 13. A variation of the distance between variable velocity split pulley 15 and outer "V" belt pulley 16 opens or closes variable velocity split pulley 15 varying the diameter of its output. Employing a constant ratedrive motor, this adjustment will vary the revolution per minute of the lower 25 and upper 32 ball propelling wheels. A motor rod lock 58 is mounted on cabinet 11 adjacent motor lift crank 57 and comprises a hand rotated clamping device for securing motor lift rod 55 in the selected adjusted position.

The components of this tennis ball propelling machine possessing the most salient novel features, in combination with the aforescribed components, is the ball feed mechanism 60. This mechanism is constructed in the top portion of the cabinet 11 frame 10 structure. Tennis balls may be delivered from the ball feed mechanism 60 through a 3 1/2 inch flexible ball feed tube 61 which is operably attached to ball feed guide 62. Ball feed guide 62 is retained in position relative the upper ball propelling wheel 32 by means of an upper ball feed guidebracket 63 which is rigidly secured to ball wheel arm 30. The lower end of ball feed guide 62 is maintained in position by means of the lower feed guide bracket 59. An important feature of ball feed guide 62 is its relative position tangentially adjacent and arcuately spaced congruent with the circumference of upper ball propelling wheel 32. The combined function of these components impart an overspin to the balls delivered by the ball propelling wheel assembly 12. At the opposite end of the ball feed tube 61 is ball hopper 64. Mounted for rotation in the base of the ball hopper 64 is a ball carrousel 65. This carrousel 65 is a cylindrical like structure approximately 9 inches in diameter and 3 inches in length. This carrousel 65 has constructed in its outer circumference four ball pockets 66 which are 2 5/8 inches in diameter. Mounted adjacent the space between these ball pockets 60 are four small raised agitation cams 67. Mounted in the center of the ball carrousel 65 is a carrousel pyramid 68 with a base of approximately four inches and a height of approximately 5 inches. In the bottom of ball hopper 64 is an opening communicating with the ball feed tube 61. A ball stop 69 projects over the carrousel 65 above this opening to insure that only one ball is delivered to the ball feed tube 61 at a time. To further prevent bridging or arching of the balls and to assist continuous feed through the ball feed mechanism 60 there is mounted adjacent the carrousel 65 an auxiliary agitator 70. This device comprises a three-pronged agi-

tator with arms of about 2 1/2 inches in length. The arms project outward from a shaft which is rotatably mounted in the interior surface of ball hopper 64. Mounted on the exterior surface of ball hopper 64 is agitator motor 71. This motor is interconnected to source of electric power and rotates the auxiliary agitator 70. Mounted on the base of ball hopper 64 is a carrousel drive motor 73 and to the shaft of this motor is secured a carrousel split drive pulley 74. Rotatably mounted in the base of ball hopper 64 is carrousel drive shaft 72. The ball carrousel 65 is mounted on and driven by this shaft 72. Secured to the lower extremity of this shaft 72 is carrousel drive pulley 75. Adjustably positioned between carrousel split drive pulley 74 and carrousel drive pulley 75 is a carrousel idler pulley 76. This pulley 76 is mounted on idler arm 77 which may be selectively positioned and secured by idler arm clamp 78. These pulleys 74, 75, and 76 are interconnected by carrousel "V" belt 79. Thus, a variation of tensioning of this "V" belt 79 by means of idler arm 77 and carrousel idler pulley 76 opens or closes the carrousel split drive pulley 74 and varies the rate of rotation of ball carrousel 65. This adjustment will determine the rate of feed of the tennis balls to the ball feed guide 62 which delivers the balls to ball propelling wheel assembly 12. A carrousel switch 80, FIG. 4, may be provided to interrupt or control the power supply to the carrousel drive motor 73. Such a switch 80 may be attached to the motor 73 by means of a long remote control cable (not shown) to permit the coach or operator of the device to control its operation from a distance.

OPERATION

In placing the tennis ball propelling machine in operation, the supply of tennis balls 81 are placed in the ball hopper 64. The power supply cables of the drive motor 13, agitator motor 71, and carrousel drive motor 73 are attached to an external electrical supply which in your preferred embodiment was the standard 110 volt AC house circuit. The wiring cables have not been illustrated or described in detail in that a well known wiring harness of conventional design was employed. The machine is faced in the direction in which it is desired to propell tennis balls 81. The hand adjusting crank 41 may be turned moving the elevation control means 39 tilting the ball wheel arm 30 which accomplishes a tilt of the ball propelling wheel assembly 12 to accomplish the projecting of the balls 81 at the desired angle.

A loosening of motor rod lock 58 will permit a movement of motor lift crank 57 which operates through motor lift rod 55 which through pivot 56 and motor board arm 53 will raise or lower motor mounting board 14 around pivot hinge 51 and thereby adjust the speed of propelling of the tennis balls 81 by the device. This variable rate of drive is accomplished through spring loaded variable velocity split pulley 15 secured to the output shaft of motor 13. The lowering of motor mounting board 14 tensions motor drive belt 21 expanding variable velocity split pulley 15 reducing its diameter which, in turn, would reduce the rate of rotation of outer pulley 16 which directly affects the rate of rotation imparted to lower ball propelling wheel 25 and the upper ball propelling wheel 32. This adjustment directly affects the velocity which balls 81 are propelled from the ball propelling space 36.

The rate of delivery of the balls 81 to the device is regulated by a loosening of idle arm clamp 78 and a movement of idle arm 77 and a positioning of carousel idler pulley 76 in a position to vary the tension of the carousel "V" belt 79 which would expand carousel split drive pulley 74 reducing its diameter thereby reducing the rate of drive of carousel drive pulley 75 and in turn the rate of rotation of ball carousel 65. With the device thus placed in the desired mode of operation, the coach or player may also control or interrupt the rate or interval of delivery of balls 81 by the carousel 65 to the device by means of carousel switch 80 which may, if desired, be connected to the carousel drive motor 73 by means of a long extension cable (not shown).

I claim:

1. A ball propelling machine comprising:
 - a. a mounting frame structurally capable of receiving and securely retaining multiple components,
 - b. a ball propelling wheel assembly, tiltably mounted on said mounting frame,
 - c. said ball propelling wheel assembly comprising:
 1. a lower ball propelling wheel rotatably mounted on said frame structure,
 2. an upper ball propelling wheel rotatably mounted above said lower ball propelling wheel and spaced therefrom, said spaced relationship defining a ball propelling space,
 - d. a ball feed guide mounted and retained tangentially adjacent and arcuately spaced concentric with the circumference of said upper ball propelling wheel at a distance sufficiently close to insure substantial continuous contact with the said upper ball propelling wheel of a ball to be propelled, said ball feed guide being positioned so as to bring a ball being propelled by the machine into contact with the said upper ball propelling wheel at a point above the said ball propelling space,
 - e. means for delivering a ball to said ball guide,
 - f. drive means for rotating selected components of said ball propelling machine,
 - g. a ball hopper including a floor mounted above said ball feed guide,
 - h. a ball feed tube interconnecting said ball hopper and said ball feed guide,
 - i. a ball carousel having substantially a cylindrical configuration, the axis of said cylinder extending upward from the floor of said ball hopper, said ball carousel rotatably mounted in said ball hopper,
 - j. a recessed cylindrical indentation constructed in the circumferential surface of said ball carousel, said indentation extending the length of said cylindrical carousel, said indentation defining a ball pocket,
 - k. an opening in the floor of said ball hopper constructed and arranged to permit a ball to pass from said ball pocket into said ball feed tube, and
 - l. a raised agitation cam secured to the upper surface of said ball carousel.
2. The invention of claim 1 further comprising a carousel pyramid secured to the upper surface of said ball carousel and projecting into said ball hopper.
3. The invention of claim 1 further comprising a ball stop secured to the interior surface of said ball hopper so positioned as to project over a said ball pocket at the position of communication with said ball feed tube.

4. The invention of claim 1 further comprising variable drive means for rotating said ball carousel at selected rates of rotation thereby varying the rate of delivery of balls to said ball propelling wheel assembly.

5. The invention of claim 4 wherein said variable drive means comprises:

- a. carousel spring loaded variable velocity split drive pulley,
- b. means for rotating said carousel spring loaded variable velocity split drive pulley,
- c. a carousel drive pulley operably secured to said carousel,
- d. a carousel "V" belt interconnecting said carousel spring loaded variable velocity split drive pulley and said carousel drive pulley, and
- e. a carousel idler pulley adjustably positioned between said carousel spring loaded variable velocity split drive pulley and said carousel drive pulley, said carousel idler pulley thereby contacting and selectively applying pressure to said "V" belt and varying tension on same thereby varying rate of drive through action of said carousel spring loaded variable velocity split drive pulley.

6. The invention of claim 4 wherein said variable drive means comprises a remote control means attached to said variable drive means to selectively activate and de-activate said drive means.

7. The invention of claim 1 wherein said drive means operably associated with said ball propelling wheel assembly further comprises:

- a. an upper ball propelling wheel drive pulley of lesser effective drive diameter than,
- b. the effective drive diameter of said lower ball propelling wheel drive pulley,
- c. and the difference of effective diameters of said pulleys causes a greater rate of rotation for said upper ball propelling wheel relative to said lower ball propelling wheel.

8. A ball propelling machine comprising:

- a. a mounting frame structurally capable of receiving and securely retaining multiple components,
- b. a ball propelling wheel assembly tiltably mounted on said mounting frame,
- c. said ball propelling wheel assembly comprising:
 1. a lower ball propelling wheel rotatably mounted on said frame structure,
 2. an upper ball propelling wheel rotatably mounted above said lower ball propelling wheel and spaced therefrom, said spaced relationship defining a ball propelling space,
- d. a ball feed guide mounted and retained tangentially adjacent and arcuately spaced concentric with the circumference of said upper ball propelling wheel at a distance sufficiently close to insure substantial continuous contact with the said upper ball propelling wheel of a ball to be propelled, said ball feed guide being positioned so as to bring a ball being propelled by the machine into contact with the said upper ball propelling wheel at a point above the said ball propelling space,
- e. means for delivering a ball to said ball guide,
- f. drive means for rotating selected components of said ball propelling machine,
- g. a ball hopper including a floor mounted above said ball feed guide,
- h. a ball feed tube interconnecting said ball hopper and said ball feed guide,

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- i. a ball carrousel having substantially a cylindrical configuration, the axis of said cylinder extending upward from the floor of said ball hopper, said ball carrousel rotatably mounted in said ball hopper,
- j. a recessed cylindrical indentation constructed in the circumferential surface of said ball carrousel, said indentation extending the length of said cylindrical carrousel, said indentation defining a ball

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- pocket,
- k. an opening in the floor of said ball hopper constructed and arranged to permit a ball to pass from said ball pocket into said ball feed tube, and
- l. an auxiliary agitator rotatably secured to and projecting into said ball hopper.

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