

Dec. 29, 1959

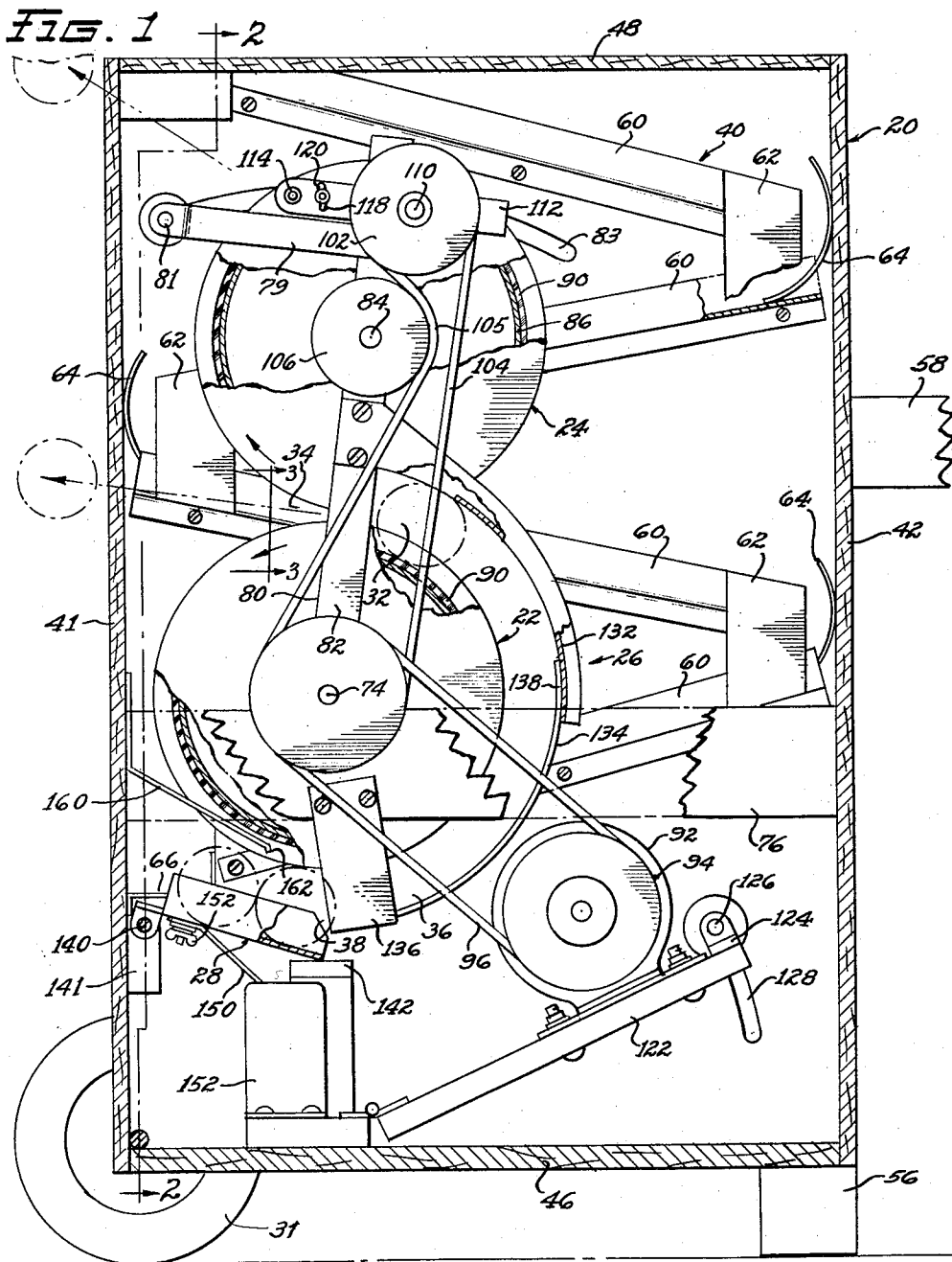
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2,918,915

TENNIS BALL PROJECTING MACHINE

Filed Aug. 26, 1957

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

FIG. 2

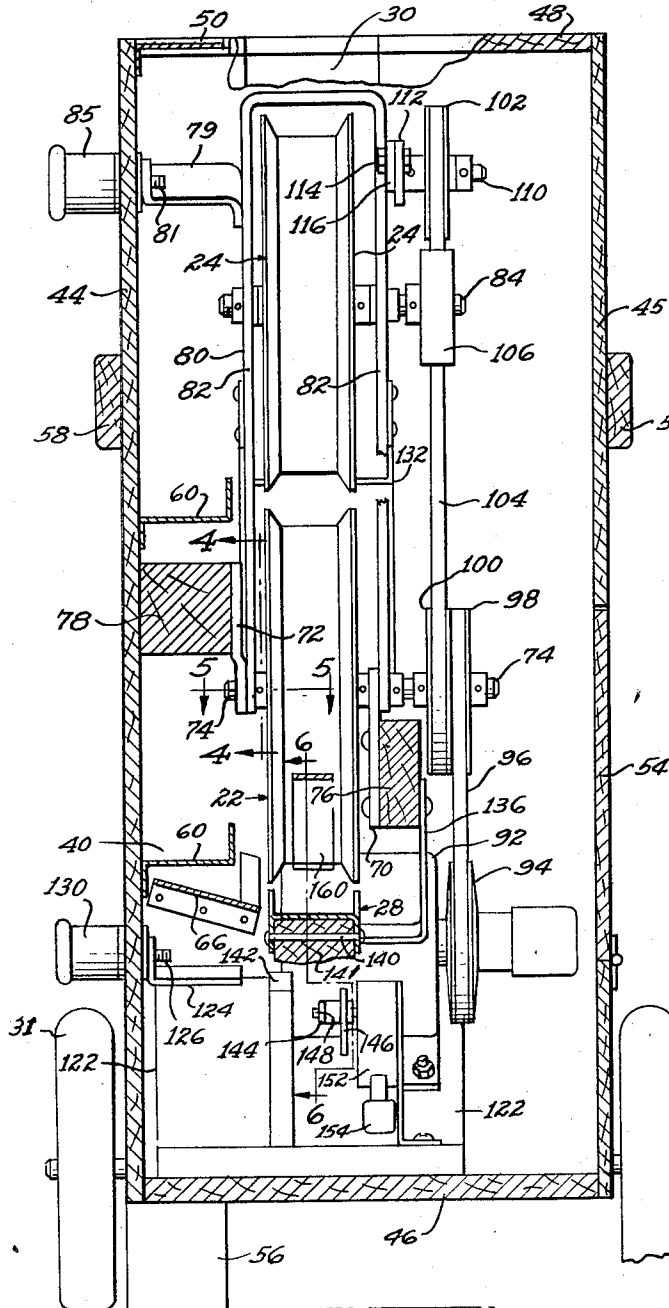


FIG. 3

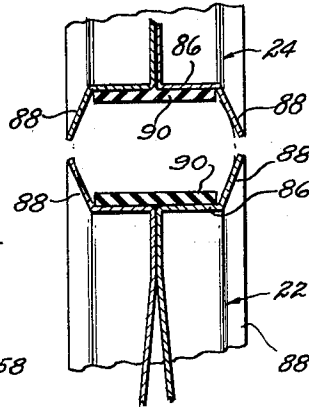


FIG. 4

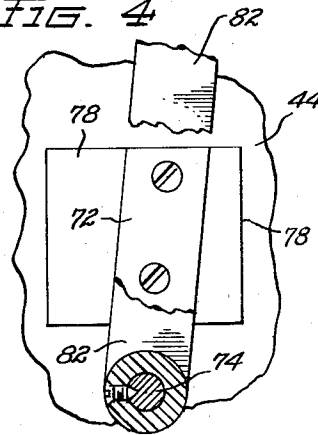
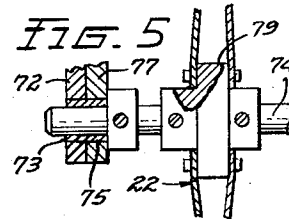


FIG. 5



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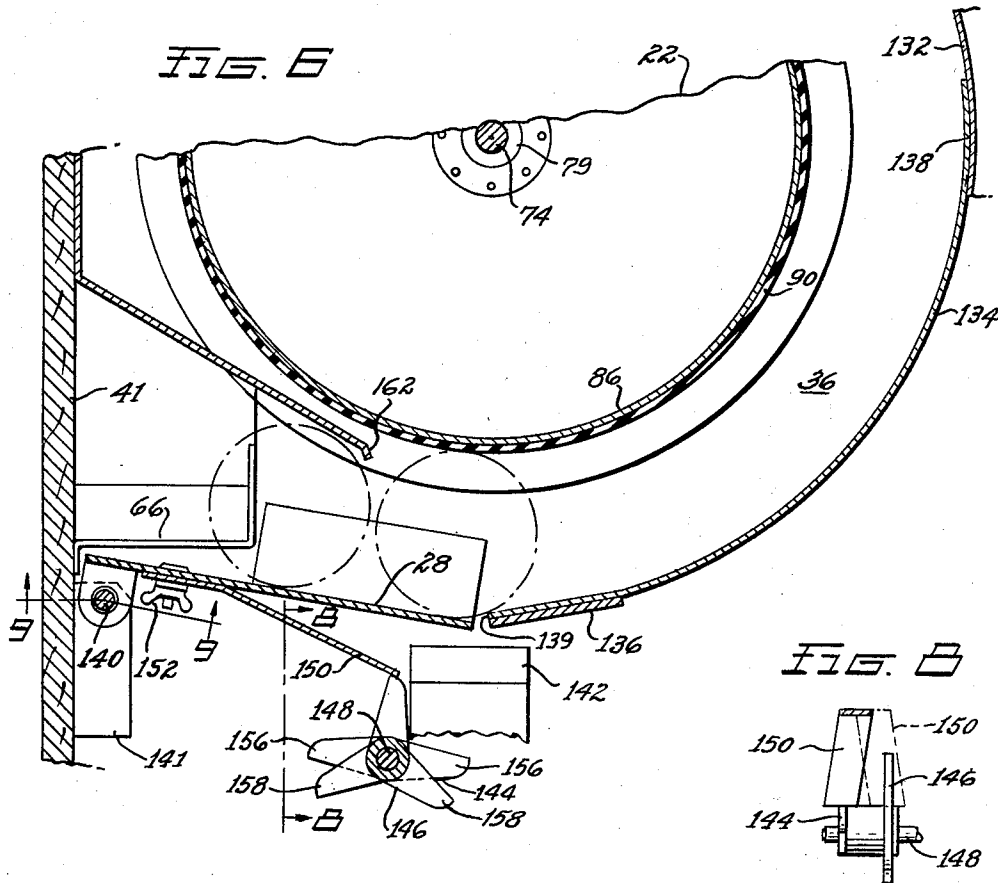
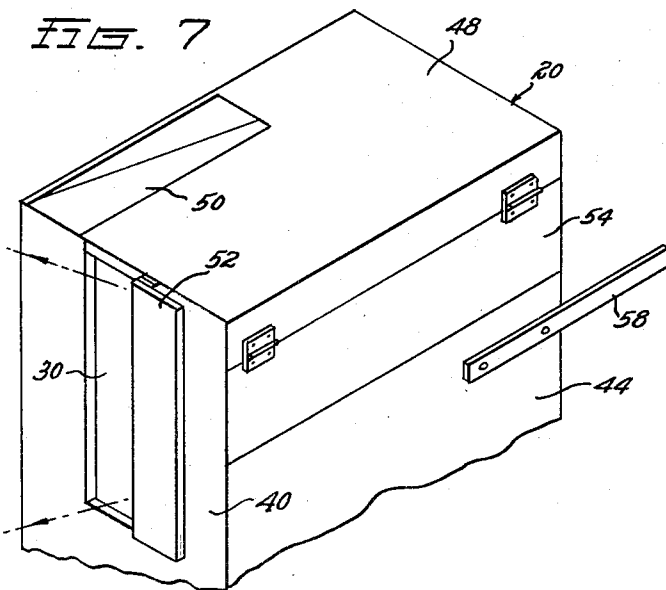
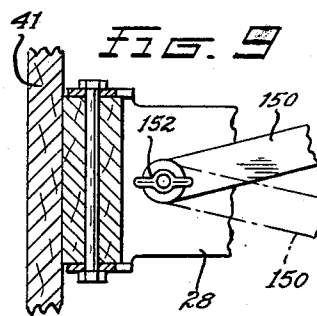
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TENNIS BALL PROJECTING MACHINE

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3 Sheets-Sheet 3



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1

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TENNIS BALL PROJECTING MACHINE

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4 Claims. (Cl. 124—1)

This invention relates generally to ball projecting machines and particularly to a machine for use in practicing the game of tennis.

The principal object of my invention is to provide an improved tennis ball projecting machine which will duplicate for practice purposes the shots ordinarily encountered in the game of tennis.

Another object of the invention is to provide an improved tennis ball projecting machine of a character that will accurately and repeatedly duplicate any selected type of tennis shot such as line drives, lobs, etc. and variations thereof in order that a student may benefit from the practice of making repeated returns of the same type of shot.

Another object of the invention is to provide a new and improved tennis ball projecting machine in which mechanical throwing arms or striking bats and their accompanying objections are eliminated.

Another object of the invention is to utilize the force of a pair of rotating wheels to project a tennis ball accurately in accordance with a selected ball trajectory, speed, etc., and to provide an injector or feed for the balls.

Another object of the invention is to provide an improved tennis ball projecting machine having provisions for feeding the balls singly to the ball projecting wheels.

A further object of the invention is to provide a tennis practice machine which will eject a ball in such manner as to cause the ball to spin and thus duplicate a well known tennis shot.

A further object resides in a sectional rollway construction to provide for adjustment of the trajectory of the ball.

A still further object of the invention is to provide a machine of the above character having a combination magazine ball dispenser and ball feed injector.

In the drawings:

Fig. 1 is a vertical sectional view of the tennis practicing machine embodying features of my invention;

Fig. 2 is another vertical sectional view of the machine, taken substantially along line 2—2 of Fig. 1;

Fig. 3 is an enlarged, fragmentary sectional view taken along line 3—3 of Fig. 1;

Fig. 4 is another enlarged, fragmentary view partly in section and taken along line 4—4 of Fig. 2;

Fig. 5 is an enlarged, fragmentary sectional view of a detail of the machine, taken along 5—5 of Fig. 2;

Fig. 6 is another enlarged, fragmentary sectional view, taken along line 6—6 of Fig. 2;

Fig. 7 is a fragmentary isometric view of my tennis practicing machine;

Fig. 8 is a view partly in elevation and partly in section of a detail of the machine, and taken along line 8—8 of Fig. 6, and

Fig. 9 is a horizontal sectional view, taken along line 9—9 of Fig. 6.

Referring to the drawings by characters of reference, the several units of my machine include a housing 20, a

2

pair of tennis ball projecting wheels 22, 24, a ball guide 26 and a ball injector or movable chute 28. The wheels 22, 24, guide 26 and chute 28 together with other devices of the machine are mounted within the housing 20 which is preferably mounted on ground wheels 31 for ease of mobility of the machine to and on a tennis court.

The ball projecting wheels 22, 24 are arranged with wheel 24 above wheel 22 and with the peripheries of the wheels in spaced apart relationship to receive and successively project tennis balls from housing 20 through an opening 30 therein. As indicated by the arrows, the wheels 22, 24 are driven in opposite directions and for convenience of description, it may be said that the wheels have a ball feed side 32 and a ball projecting side 34. The guide 26 cooperates with the periphery of wheel 22 to provide an arcuate rollway 36 having a lower ball inlet 38 below wheel 22 and an upper ball outlet at the feed side 32 of the ball projecting wheels 22, 24. Mounted at the inlet 38, the movable chute 28 is adapted to feed tennis balls into the rollway 36, and a ball magazine or fixed chute 40 feeds balls by gravity to the movable chute 28.

Referring now in detail to my machine, the housing 20 may be a wooden structure having a front wall 41, a rear wall 42, side walls 44, 45, bottom wall 46 and a top wall 48. In the housing top wall 48 is a ball loading inlet 50 to the chute 40, and in the housing front wall 41 is the opening 30 through which balls are projected out of the housing. The opening 30 is preferably a rectangular opening that is elongated vertically so as to accommodate different ball trajectories. A hinge door 52 may be provided for the opening 30 and the walls of the housing may have other hinged doors, as at 54 (Figs. 2 and 7), for access to the mechanisms of the machine. The access doors 54 also provide a safety measure against anyone reaching in and getting injured by the machinery. Also, the doors facilitate the use of the housing as a shipping box for the machine. On shipping the machine, the ground wheels 30 and other external appurtenances, such as the feet 56 and handles 58, are removed and stored within the housing.

The ball magazine, or chute 40 is arranged to hold a large number of tennis balls and is constructed inexpensively by securing several angle sections 60 to the housing side wall 44. As shown, the uppermost chute section 60 extends inclined from the ball loading inlet 50 downwardly toward the housing rear wall 42 and successive sections of the chute 40 are alternately reversely inclined so that the balls will roll by gravity from inlet 50 down the several sections of the chute. Where the balls pass from one chute section to the next, the adjacent ends of the chute sections are joined by side plates 62 to retain the balls in the chute, and at said adjacent ends of the sections, arcuate baffles 64 are provided to provide for continuous rolling of the balls from one chute section to the next. The lowermost section 60 of the ball storing chute 40 discharges into a laterally extending fixed chute 66 which in turn discharges into the movable ball injector chute 28.

Within the housing 20 are horizontally spaced supports or brackets 70, 72 that rotatably support a shaft 74 on which the wheel 22 is mounted for rotation therewith. Bracket 70 is secured to a wooden timber 76 that is in turn secured at its opposite ends to the front and rear walls 41, 42 respectively of housing 20. Similarly, bracket 72 is secured to the inner face of a wooden block 78 that in turn is secured to the housing side wall 44. The wheel 22 may be secured at its hub 79 for rotation with shaft 74 by set screws or by any other suitable means. Pressed into each of a pair of aligning apertures in the brackets 70, 72 is a bushing 73 (see Fig. 5) for shaft 74 and this bushing 73 extends inwardly, as at 75, providing pivots

for a yoke type support 80 which supports upper wheel 24 on shaft 74. By supporting wheel 24 on a yoke having its pivots 75 concentric with the center of lower wheel 22, the upper wheel 24 may be moved relative to lower yoke. To provide for such an adjustment, the side 82 of wheel 22 about the axis thereof to change the ball trajectory 80 carries a clamp 79 that extends toward the housing side wall 44, and a screw 81 threaded into clamp 79 extends through an arcuate slot 83 in wall 44. Fixed on its outer end, the screw 81 has a hand knob 85 by means of which the screw 81 may be readily tightened to hold the yoke 80 and therefore wheel 24 in the desired adjusted position. The arcuate slot 83 has its center of radius concentric with the center of rotation of wheel 22, and the front and rear ends of the slot correspond to limits of low and high ball trajectories respectively. In the position shown (see Fig. 1), with screw 81 at the forward end of the slot 83, the wheels 22, 24 will project balls at a low trajectory angle, comparable to a low line drive whereas, if the yoke 80 is swung back so that clamping screw 81 is at the rear end of slot 83, the angle of trajectory will be raised such that the machine will project the ball at a high trajectory similar to the shot known in tennis as the "lob".

The yoke 80 has its elongated sides 82 arranged to straddle the wheels 22, 24 and a web joins the sides 82 together outwardly of the periphery of wheel 24. Wheel 24 is mounted on a shaft 84 which like the shaft 74 of wheel 22 may be rotatably mounted in bushings that are pressed into aligning apertures in the yoke sides 82. The wheels 22, 24 are thus arranged with the peripheries thereof in opposed relation and the wheels are arranged such that the space therebetween is considerably less than the diameter of a regulation tennis ball. Thus, it will be apparent that a ball fed between the wheel peripheries is squeezed and displaced thereby and by friction is ejected by the force of the tangential surface speed of the wheels.

The wheels 22, 24 are of like construction, each having a drop center rim 86 and circumferential retainer flanges 88 which function to retain and center the balls. To insure against slippage between the wheel rims 86 and the tennis balls, I provide each wheel rim with a friction facing 90 in the form of a band, which may be rubber or other suitable material.

An electric motor 92 is employed to drive the ball projecting wheels 22, 24 preferably by pulleys and belts including a driving pulley 94 that is connected by a belt 96 to a driven pulley 98 which is fixed on the shaft 74 of wheel 22. Also fixed on shaft 74 is a second driven pulley 100 that drives an idler pulley 102 by means of a belt 104 from the drive side 105 of which is driven a pulley 106 that is fixed on the shaft 84 of upper wheel 24. This arrangement, of course, provides for driving of wheels 22, 24 in opposite directions as required to project the balls. To further simulate certain characteristics of a tennis ball shot delivered by an experienced player, I provide for putting vertical spin on the ejected ball. This may be accomplished by having a differential in the surface speeds of wheels 22, 24 with the upper wheel 24 preferably having the greater surface speed. This may be had as shown in Fig. 1 if pulley 106 is smaller in diameter than pulley 100 or if desired, the wheel 22 may be of smaller diameter than wheel 24.

Preferably, the machine has some provision for adjusting the tension of belt 104, and in the present machine such adjustment is made by moving the position of the idler pulley 102. To this end, pulley 102 rotates on a stub shaft 110 that is fixed at one end thereof to an arm 112 which is pivoted at 114 to an extension 116 of the yoke 80. The position of pulley 102 may be adjusted within the limits or ends of an arcuate slot 118 in arm 112 and be held in adjusted position to extension 116 by a bolt and nut 120, or other suitable means.

The machine has provision for adjusting the distance of projection of the balls, the adjustment being made by changing the speed of rotation of the ball projecting wheels 22, 24. This may be done successfully and economically by using as the drive pulley 94 that type of pulley which has a variable effective diameter responsive to belt tightness. The pulley 94 is not shown or described in detail as it is a well known type of drive pulley. However, in general, pulley 94 has inclined movable side flanges that respond to tightening of belt 96 by moving apart in such manner as to reduce the effective diameter of the pulley. To tighten or loosen the belt 96, the pulley 94 and drive motor 92 are mounted on a hinged support 122. Secured to the support 122 is a bracket 124 that carries a threaded stud 126 which projects through an arcuate slot 128 in the housing side wall to receive a hand knob 130 by means of which to move the support 122 and to clamp it in adjusted position to housing side wall 44.

The ball guide 26 comprises an upper arcuate section 132 and a lower arcuate section 134. The upper guide section 132 is carried by the yoke 80 whereas the lower guide section 134 is fixed by means of an angle bracket 136 to the member 76. As is shown more clearly in Fig. 1, the sections 132, 134 have overlapping end portions, as at 138, which are slidably engaged to allow for movement of the yoke 80 about its axis in making the aforementioned trajectory adjustment. The lower or inlet end of guide section 134 is below the wheel 22 and provides a ball stop 139 to prevent balls from falling out of the chute 28.

Referring now to the ball injecting chute 28, this chute is preferably a channel member pivoted at one end thereof by a horizontal pin 140 to a block 141 that is secured to the housing front wall 41. The chute 28 is open-ended having its pivoted end in communication with the discharge of the fixed chute section 66 and having its free end disposed toward the inlet to railway 36. As shown in Fig. 1, the chute is inclined and extends downwardly from its pivoted end to its free or discharge end, the free end of the chute normally resting on a resilient stop 142.

Mounted within housing 20 below the chute 28 is chute operating means or cams 144, 146 of which there are two in the present disclosure although one or more may be used, if desired. The cams 144, 146 are fixed on a cam shaft 148 in spaced relation therealong, and a spring cam follower 150 is carried by the chute 28. A speed reduction mechanism or timer in casing 152 is driven by an electric motor 154 to rotate cam shaft 148 and thus cams 144 and 146. The cam follower 150 is in the form of a leaf spring that is attached near one end thereof to the underside of the chute 28 near the chute pivot, by a wing nut 152. The cam follower 150 extends downwardly from the chute 28 at an inclination thereto, and the free end of the cam follower 150 rides on one or the other of the cams 144, 146, as desired. Cam 144 has two lobes 156 and cam 146 three lobes so that the rate of projection of balls from the machine can be changed by moving the cam follower from one of the cams to the other. Thus, when using cam 144, a player must execute two return shots for each revolution of cam shaft 148, whereas when using cam 146 he must execute three return shots for each revolution of cam shaft 148. By this arrangement, a player may practice the return of certain fast shots that require quick reflexes and established technique and form, or he may practice the return of slower shots, such as the lob which require different technique and form.

In addition to controlling the rate of projection of balls from the machine, the chute 28 has the further function of cooperating with a ball stop or finger 160 providing a dispenser for the ball magazine to insure that balls are projected singly at spaced intervals. The finger 160 is secured at one end thereof to housing wall 41 and extends over the chute 28 adjacent the periphery of wheel

22 such that an end portion of the finger overlies the second ball in chute 28. At its free end, the finger has a retainer flange 162 that keeps the second ball from rolling down chute 28 until the chute 28 is allowed to swing down to its lower or inactive position. Thus each time that the chute 28 is moved counterclockwise (Fig. 6), the first ball only is injected into rollway 36, and on return of the chute the next ball rolls into the first position in chute 28.

Operation

The machine is for use primarily on a tennis court and is placed on the opposite side of the net from the player. The machine may be adjusted to any type shot that the player wishes to practice and the motors 92 and 154 which may have a common circuit are started, such as by connecting the circuit to a power line. About forty-five balls can be stored in the magazine 60 and the lowermost and second ball will be in the ball dispenser injector or chute 28, as shown in Figs. 1 and 6. The cam follower 150 is adjusted to ride on either the two-lobe cam 144 or the three-lobe cam 146, as desired, and each time a lobe tensions the spring follower 150, the chute 28 is swung up and presses the lowermost ball against the periphery friction band 90 of lower wheel 22. As a result, the ball is forced by the wheel 22 into the rollway 36 wherein the ball is displaced or deformed since the distance between the periphery of friction band 90 and guide 134 is considerably less than the diameter of the ball. Carried up the rollway 36, the ball emerges from the upper end of the rollway, but not before the ball is urged against the friction band 90 of upper wheel 24. Thus the ball still deformed is now engaged by both wheels 22, 24 and is projected by friction at the peripheral velocities of the wheels through the housing opening 30. Since the upper wheel 24 is traveling at a greater peripheral velocity than lower wheel 22, it will be seen that a vertical spin will be applied to the ball much like the spin applied to a tennis ball by an experienced player. When the first ball in chute 28 is urged into the rollway 36, the upward swing of the chute cooperates with finger tip 162 to retain the second ball so that not more than one ball at a time enters the rollway. At the same time this action of chute 28 controls dispensing of the balls from the ball magazine into the chute. As previously mentioned, the trajectory of the ball may be adjusted by loosening knob 85 and swinging yoke 80, wheel 24 clockwise about shaft 74 to a position corresponding to the desired trajectory. Also, the interval of discharge may be changed by changing the cam follower 150 from one to the other of cams 144 and 146 and the speed of projecting of the balls may be changed by repositioning the hinged support 122 to vary the effective diameter of drive pulley 94.

From the foregoing detail description, it will now be understood that I have provided an improved ball projecting machine for practicing the game of tennis. It will be appreciated that I have provided an improved tennis ball projecting machine in which it is both possible and practical to utilize a pair of wheels, with their accompanying advantages over bats and throwing arms, as the ball projection means. It should also be appreciated that I have provided a tennis ball projection machine in which a combination ball dispenser and ball injector dispenses balls from a ball magazine and at the same time in cooperation with one of the wheels injects or feeds a ball for projection by the pair of wheels. Furthermore, I have provided a machine of the above mentioned character in which the said ball dispenser ejector functions to insure that the balls will be projected singly. In addition, I have provided a machine in which the cooperating elements facilitate the provision of adjustments for ball trajectory, speed, rate of projection, etc.

While I have shown and described my invention in considerable detail, it will be appreciated that the inven-

tion may have many variations without departing from the spirit and scope of the invention.

I claim:

1. A tennis ball projecting machine comprising, a housing having a ball loading inlet and ball outlet, a wheel rotatably mounted within said housing, a second wheel rotatably mounted within said housing and spaced vertically above the first wheel, said wheels arranged with their peripheries spaced apart to receive and grip a tennis ball and project the ball through said outlet, said wheels each having spaced apart peripheral flanges to retain and center a ball therebetween, an arcuate guide concentric with the axis of said first wheel arranged in spaced relation to the periphery thereof, said guide forming a ball rollway having a lower ball inlet below said first wheel and an upper outlet directed between the opposed peripheries of said wheels on the feed side thereof, a ball chute pivoted to said housing and having a free open end disposed toward the inlet to said rollway, said chute pivoted from a normally downwardly inclined position upwardly to a position to press a ball at the free end of the chute upwardly against the periphery of the first wheel for feeding by the latter into the inlet of said rollway, stop means stopping discharge of the ball when the chute is in said downwardly inclined position, means to drive said wheels in opposite directions at different peripheral speeds, and a cam to pivot said chute.

2. A tennis ball projecting machine comprising, supporting means, an upper wheel mounted on said supporting means, a lower wheel mounted on said supporting means, said wheels arranged with the peripheries thereof in spaced opposed relation a distance apart to grip and displace a ball and project the ball therefrom by friction at the peripheral speeds of said wheels, means to drive said wheels in opposite directions, an arcuate guide in spaced relation to the periphery of said lower wheel and concentric therewith, the periphery of said wheel and said guide forming a rollway having a lower ball inlet and an upper ball outlet, said outlet adjacent to and directed between the opposed peripheries of said wheels, a ball magazine having an outlet spaced from the end of said rollway, a pivoted chute disposed between the outlet of said magazine and the inlet of said rollway and having the free end of the chute toward said inlet, means normally holding said chute in a position inclined downwardly from the outlet of said magazine to induce a ball to roll by gravity to the free end of said chute, means at the inlet of said rollway stopping the ball from falling out of said chute when the chute is in said position, said chute pivotable in a direction urging the ball therein against the periphery of said lower wheel to effect feeding of the ball into said rollway, means cooperable with said chute only upon pivoting of said chute in said direction to stop movement of a second ball by gravity down said chute, and a plurality of timing cams selectively operable to pivot said chute.

3. A tennis ball projecting machine comprising, supporting means, an upper wheel mounted on said supporting means, a lower wheel mounted on said supporting means, said wheels arranged with the peripheries thereof in spaced opposed relation a distance apart to grip and displace a ball and project the ball therefrom by friction at the peripheral speeds of said wheels, means to drive said wheels in opposite directions, an arcuate guide in spaced relation to the periphery of said lower wheel and concentric therewith, the periphery of said wheel and said guide forming a rollway having a lower ball inlet and an upper ball outlet, said outlet adjacent to and directed between the opposed peripheries of said wheels, a ball magazine having an outlet spaced from the end of said rollway, a pivoted chute disposed between the outlet of said magazine and the inlet of said rollway, means normally holding said chute in a position inclined downwardly from the outlet of said magazine to receive a ball therefrom by gravity, means on the inlet of said rollway

7

stopping the ball from falling out of said chute when the chute is in said position, said chute pivotable to a second position urging the ball therein against the periphery of said lower wheel, means cooperable with said chute in said second position stopping movement of a second ball by gravity down said chute, and a plurality of timing cams of relatively differential rates of operation and selectively operable to pivot said chute.

4. A tennis ball projecting machine comprising, supporting means, an upper wheel mounted on said supporting means, a lower wheel mounted on said supporting means, said wheels arranged with the peripheries thereof in spaced opposed relation a distance apart to grip and displace a ball and project the ball therefrom by friction at the peripheral speeds of said wheels, means to drive said wheels in opposite directions, an arcuate guide in spaced relation to the periphery of said lower wheel and concentric therewith, the periphery of said wheel and said guide forming a rollway having a lower ball inlet and an upper ball outlet, said outlet adjacent to and directed between the opposed peripheries of said wheels, a ball magazine having an outlet spaced from the end of said rollway, a pivoted chute disposed between the outlet of said magazine and the inlet of said rollway, means normally holding said chute in a position inclined downwardly from the outlet of said magazine to receive a ball therefrom

8

by gravity, means on the inlet of said rollway stopping the ball from falling out of said chute when the chute is in said position, said chute pivotable to a second position urging the ball therein against the periphery of said lower wheel, means cooperable with said chute in said second position stopping movement of a second ball by gravity down said chute, a pair of cams to individually pivot said chute, said cams operable to pivot said chute at relatively different rates, and a spring finger cam follower pivoted at one end thereof to said chute, said follower pivotable on said chute to position the free end of the follower in engagement with one or the other of said cams.

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