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BALL PROJECTOR

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2 Sheets-Sheet 2

Fig. 4.

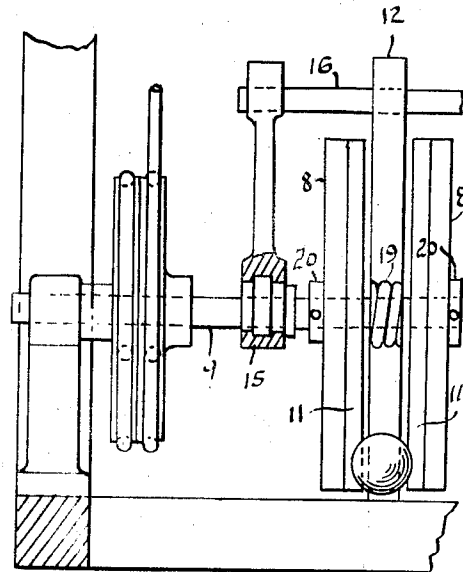
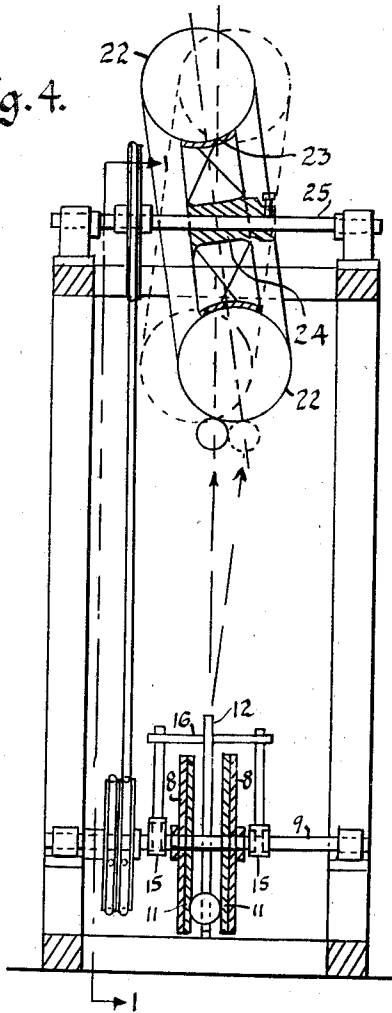


Fig. 5.

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## UNITED STATES PATENT OFFICE

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## BALL PROJECTOR

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7 Claims. (Cl. 124—6)

This invention relates to equipment whereby one or more persons can play a game or take exercise by batting or throwing a ball, such as a tennis ball, against a net or curtain, from which it will automatically be returned toward the player by a machine in a manner simulating a return by another person, that is, with variable force and angle at haphazard.

One object of the invention is to provide a surface such as a curtain or net against which a ball can be driven with considerable force, and which is soft and pliable enough to arrest the forward flight of the ball and then let it drop into a collecting trough placed along the bottom of the curtain. This trough is to be inclined so as to permit the ball to roll toward a branch conduit, and so to convey the ball from the curtain to the ball throwing machine.

Another object of the invention is to provide a ball throwing machine which will seize the ball from the collecting trough and throw it out over the playing area from a height somewhat above three feet.

Other objects of the invention are to provide a continuously moving, rotary ball-throwing device which impresses a stroking effect on the ball, and which also automatically throws the ball at haphazard angles and velocities.

These and other objects of the invention will be evident by reference to the accompanying drawings, wherein like parts are identified by the same reference characters throughout the several views.

In the drawings:

Figure 1 is a side view of the ball throwing machine itself, taken along the line I—I in Figure 4, or just within one of the side support frames. It shows this machine placed behind the curtain and returning the ball through a hole provided in the curtain.

Figure 2 is a plan view (in a smaller scale), of a suitable court whereon this game or exercise can be practiced.

Figure 3 is a plan view showing an arrangement for an indoor room or other limited area, where curtains and troughs are placed along two sides of a square, with the ball throwing machine placed in one corner and in front of the curtains.

Figure 4 is a vertical section along the broken line 4—4 in Figure 1; that is, taken through the shafts of the two actuating rotary members.

Figure 5 is an enlarged sectional view taken on the line 4—4 of Figure 1 but showing only the tossing mechanism.

The play of the game or exercise, as well as the action of the equipment, can be understood best by following the movement of the ball. Thus, in Figure 1, assume that the player has batted a tennis ball against the curtain 1. 5 Wherever it strikes, above the level of the trough 5, and within the area of the curtain, it will be arrested in its flight and will fall into the collecting trough 5. If it strikes below the trough 5, it will hit the hard board 6 and so 10 rebound toward the player.

The collecting trough 5 is inclined from its ends down toward the middle so as to cause the ball to roll to the center, where it passes into the cross branch trough 7. This short trough 15 is also inclined so as to cause the ball to advance along under the curtain and in between the two rotating tossing discs 8.

These tossing discs 8 are keyed onto a shaft 9 and rotated together by means of a pulley and 20 belt from the variable speed electric motor 10, through the control box 18. These discs are adjustably spaced apart about the diameter of a ball, and their inner faces are covered with thick, soft pads 11. These discs 8 are rotated 25 so that their lower edges move in the same direction as the entering ball, so that the ball is seized off the guiding trough 7 by and between the soft faces of the discs.

The ball is prevented from at once escaping 30 from between the discs by the guide 12, anchored to the frame at 13, and spaced between the rotating discs 8. The curvature of this guide is varied by the movement of the pair of eccentrics 15 and the cross-bar 16. Thus, the ball is 35 held between the discs 8 until it reaches variable locations below the upper "stroking" wheel 22, as determined by the fixture of the guide 12 up to the point 17. Due to centrifugal force, the ball now tends to follow the guide 12 and thus 40 escapes from between the tossing discs 8 and is thrown at variable angles up against the stroking wheel 22.

It is important to note at this juncture that the spacing of the discs 8 on the shaft 9 is de- 45 termined by the diameter and weight of the ball, the character of the padding 11, and by the speed of the rotation of the discs themselves, so that just the right pressure must be exerted to seize the ball as it enters between the discs and yet 50 release it sufficiently to allow it to escape along the path of movement determined by the guide 12. The nice adjustment required for this action is obtained by giving the discs 8 a little longitudinal freedom along the shaft 9 and holding 55

them spaced apart by the spring 19 coiled around the shaft 9, and the adjusting nuts 20 between each disc 8 and the eccentrics 15.

The preceding describes the operation of an outside guide 12, but the same effect may be obtained if, alternatively, the outside guide 12 is replaced by an inner guide 14, supported at 21 and bent around inside the orbit of the ball from the shaft 9, shown in Figure 1 in broken lines. In this case, the adjustment of the space between the discs 8 would be tighter than before, so as to hold the ball against centrifugal force until finally edged out by the inner guide 14. In this case, also, the curvature and position of the inner guide would be varied by connection with the pair of eccentric rods 15, or equivalents, in substantially the same manner as previously indicated for the outside guide 12.

Having thus followed the ball through the tossing discs 8, it is now seen as rising at variable angles up against the under side of the stroking wheel 22, which is driven by a belt from the variable speed motor 10. In this case, the stroking wheel is rotated in the opposite direction from that of the disc wheels 8, thus imparting the effect called "top spin" to the ball as it is driven out through the aperture 26 in the curtain 1. It should be here noted that if the ball-throwing machine were placed in front of the curtain, both wheels would be driven in the same direction.

In this particular machine, the actual striking surface of the stroking wheel 22 consists of an automobile tire inner tube, inflated just enough to hold it out into shape on a wire spoke wheel 23. Thus, when the ball is tossed up against the surface of this tire tube it makes a slight indentation, which becomes at once a thrusting face against the ball, due to the rotation of the tire wheel itself.

While the above mentioned auto tire tube has been found to give a cheap and satisfactory surface for the purpose of this invention, it must be understood that several other types of wheels might be employed here to the same end without changing the intent of this disclosure.

It should now be noted, (also, that this stroking wheel 22 is mounted and keyed onto the shaft 25 in a plane slightly inclined from the vertical. Thus, as it rotates, the stroking surface presented toward the rising ball moves across the center from side to side, and being a curved surface in itself, it imparts a forward thrust to the ball at variable horizontal angles. The degree of inclination of the plane of the stroking wheel 22 is fixed so that the maximum angle is not too wide for the area of the court.

The combination, then, of the variation in angle of upthrust imparted by the tossing discs 8, together with the variation in horizontal angle imparted by the stroking wheel 22, gives an altogether unpredictable direction of flight to the ball, subject of course, to the limitations of adjustment needed to keep the course of the ball within the bounds of the court.

The degree of inclination of the stroking wheel 22 is determined by the eccentricity of the bushings inside the wheel hubs 21. These are changeable to suit the player. Likewise, the centering of the stroking wheel 22 on the shaft 25 may be changed by sliding on its bay automatically or else by hand, so as to give a preponderance of throws to one or the other side of the center line as desired.

It will be obvious now, also, that the same gen-

eral principle employing the two rotary elements of spaced discs and stroking wheel can be developed in other ways to serve the same purpose. Thus, the discs can be increased sufficiently in diameter to get all the lift needed without actually tossing the ball away from themselves. In this case, the force holding the discs together may be controlled as by a solenoid, and the stroking wheel surface made to turn between the faces of the discs. The ball will thus be struck out from between the discs by the stroking surface itself before it can otherwise escape.

Turning now to the Figures 2 and 3, it will be evident how a player can bat or throw a ball toward the curtain at the end of the court, where it will be retrieved and thrust back toward him at haphazard angles and velocities. The variation in the speed of the returns seems to be partly due to the variations in speed of the toss and partly to the position of contact between the ball and the stroking wheel surface, all assuming a constant speed drive.

In connection with the above, it should now be noted that an additional element of variation can be injected into the combination by making the speed of the motor variable. There is a considerable fly-wheel effect in the combination of wheels shown so that changes in motor speed will not be at once effective but a continuously varied power supply to the motor through an automatic control as at 18 will nevertheless give a marked variation in the force of the returns.

On the other hand, these extra variations in speed depending upon motor control may be left to the player, so that he can increase or diminish the force of the machine's returns depending upon his ability to handle them, by the proper rheostat control of the driving motor speed.

Another interesting possibility presents itself in using more than one ball; thus a player may have two or more in play at once, depending upon his ability to retrieve them as fast as they are returned to him by the machine.

It should also be noted that more than one player may take part in this game or exercise at the same time. Thus, two or more players can take turns at driving the ball back to the curtain. Moreover, the curtain and the floor area, or both, may be laid out in marked areas, so that "call shots" may be attempted by way of developing a competitive contest, either against another player or against the machine itself.

In another variation of the positioning of the ball-throwing machine and the collecting curtains, the machine may be placed at some distance from one of the curtains and made to throw toward it—the connecting ball chute in this case being correspondingly longer.

Again, the machine may be placed back of one curtain and throw through it toward another. A variety of such combinations may be used in the development of games.

The foregoing description gives the details of construction and assembly for equipment found suitable for the purposes of this invention, but it should be understood that changes may be made in the various items involved without departing from the substance of the broad development, the scope of which is indicated in the following claims.

I claim:

1. In a device of the class described, the combination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted

and rapidly driven ball-tossing discs with a laterally adjustable space between them and adapted to receive and grip the ball between them as it comes from a player, and carry it partly around the path of approximately circular travel to a predetermined location, and means for guiding and releasing the said ball at the said location in such a manner that its acquired momentum will project it upwardly against the ball-stroking mechanism, said mechanism including a rapidly revolving stroking wheel adapted to receive the ball tossed by the ball-tossing mechanism and also adapted to project the ball outwardly toward the player.

2. In a device of the class described, the combination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted and rapidly revolving ball-tossing discs with laterally adjustable space between them and with resilient faces adapted to receive and grip the ball between them as it comes from a player and carry it partly around the path of approximately circular travel to a predetermined location, and means for guiding and releasing the said ball at the said location in such a manner that its acquired momentum will project it upwardly at varying angles against the ball-stroking mechanism, said mechanism including a stroking wheel adapted to change the direction of movement of the ball tossed against it by the ball-tossing mechanism and to project the ball outwardly toward the player.

3. In a device of the class described, the combination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted and rapidly revolving ball-tossing discs with a laterally adjustable space between them and inner resilient faces adapted to receive and grip the ball between them as it comes from a player and carry it partly around the path of approximately circular travel; means for guiding and releasing the said ball at variable locations on its path in such a manner that its acquired momentum will project it upwardly at varying angles against the ball-stroking mechanism, said mechanism including a rapidly revolving shaft and a stroking wheel mounted thereon adapted to change the direction of movement of the ball tossed against it by the ball-tossing mechanism and to project the ball outwardly toward the player.

4. In a device of the class described, the combination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted and rapidly revolving ball-tossing discs with a laterally adjustable space between them and inner resilient faces adapted to receive and grip the ball between them as it comes from a player and carry it partly around the path of approximately circular travel; mechanically operated means for guiding and releasing the said ball at variable locations on its path in such a manner that its acquired momentum will project it upwardly at varying angles against the ball-stroking mechanism, said mechanism including a rapidly revolving shaft and a stroking wheel mounted thereon adapted to change the direction of movement of the ball tossed against it by the ball-tossing mechanism and to project the ball outwardly toward the player.

5. In a device of the class described, the com-

bination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted and rapidly revolving ball-tossing discs with a laterally adjustable space between them and inner resilient faces adapted to receive and grip the ball between them as it comes from a player and carry it partly around the path of approximately circular travel; mechanically operated means for guiding and releasing the said ball at variable locations on its path in such a manner that its acquired momentum will project it upwardly at varying angles against the ball-stroking mechanism, said mechanism including a rapidly revolving shaft and a stroking wheel mounted thereon adapted to change the direction of movement of the ball tossed against it by the ball-tossing mechanism and to project the ball outwardly toward the player, said means consisting of so mounting the said wheel that its vertical plane is inclined to the horizontal axis of its shaft.

6. In a device of the class described, the combination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted and rapidly revolving ball-tossing discs with a laterally adjustable space between them, and inner resilient faces adapted to receive and grip the ball between them and carry it partly around the path of approximately circular travel; an outer guide located exteriorly to the path of said ball between said discs, said guide being adapted to confine the ball to said path, and mechanical means for varying the position of said guide adapted to release said ball from the grip of said discs at variable locations on its path in such a manner that its acquired momentum will project it upwardly at varying angles against the ball-stroking mechanism, said mechanism including a rapidly revolving shaft and a lightly inflated stroking wheel mounted thereon adapted to change the direction of movement of the ball tossed against it by the ball-tossing mechanism and to project the ball outwardly toward the player, said means consisting of so mounting the said wheel that its vertical plane is inclined to the horizontal axis of its shaft.

7. In a device of the class described, the combination of a ball-tossing mechanism and a ball-stroking mechanism, the said ball-tossing mechanism consisting of a pair of rotatably mounted and rapidly revolving ball-tossing discs with a laterally adjustable space between them, and inner resilient faces adapted to receive and grip the ball between them and carry it partly around the path of approximately circular travel; an inner guide preferably of resilient material located between said discs and so curved as to release the said ball from the grip of said discs at variable locations on its path in such a manner that its acquired momentum will project it upwardly at varying angles against the ball-stroking mechanism, said mechanism including a rapidly revolving shaft and a lightly inflated stroking wheel mounted thereon adapted to change the direction of movement of the ball tossed against it by the ball-tossing mechanism and to project the ball outwardly toward the player, said means consisting of so mounting the said wheel that its vertical plane is inclined to the horizontal axis of its shaft.

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