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DEVICE FOR THE AUTOMATIC THROWING OF BALLS FOR TRAINING FOR CERTAIN SPORTS

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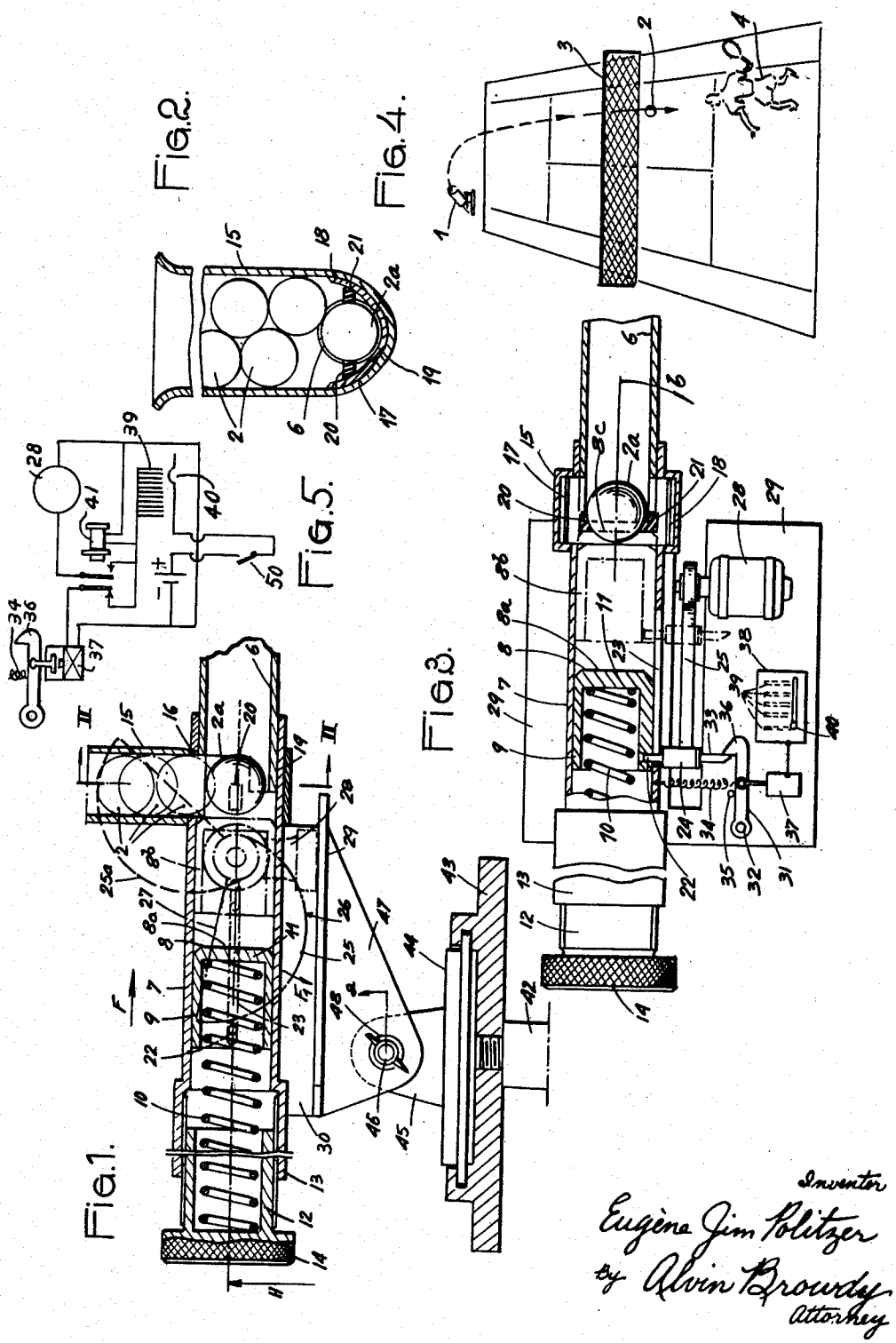


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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DEVICE FOR THE AUTOMATIC THROWING OF BALLS FOR TRAINING FOR CERTAIN SPORTS

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The practice of sports necessitates long training, both theoretical as well as physical, until the various movements required for correctly accomplishing gestures become automatic. The acquiring of this automatism may sometimes require years of exercise or training, of which part is often tedious and carried out with the help of a trainer or teacher. Even after this stage, exercise remains necessary for keeping up said automatism. This is the case of certain sports practiced with balls such as tennis or ping-pong, for acquiring and improving mastery of the player.

Up till now, persons indulging in these sports, or wishing to learn them or improve themselves in them, had to obtain the help of a partner, teacher or trainer. To this end, the latter threw a ball, so that the pupil or player returned it over the net by striking the ball with his racket and carrying out certain movements in a proper position for the body, by applying rules that had been drawn up.

These throws and returns must be made a very large number of times for them to become correct and automatic. As there are a certain number of strokes, denoted by: "Forearm stroke," "back-stroke," "drive," "smash," "volley," "half-volley," "service," etc., each of them has to be the subject of a special and prolonged training, both with beginners for learning them, as well as for players for improving, and even for champions, for retaining their reflexes.

The teacher or trainer must thus throw the ball so that it always falls at the same spot in front of the pupil or player being trained, which is difficult, tedious, and tiring in the long run. Now, the usual practice which consists of playing with one or more partners does not respond to a methodical training for each of the strokes mentioned above. Furthermore, there is a difference in the degree of mastery of the sport under consideration and the necessity of having the time to spare for each one of the players. Moreover, the help of a teacher or trainer is always expensive, and is only fully justified when the latter are unsparing in their theoretical and practical advice.

The present invention has the purpose of an automatic device which enables the teacher or trainer to be replaced for the mechanical effort of throwing a ball a great number of times.

According to the invention, the automatic device comprises a throwing tube extending from a loading chamber associated with a magazine, then motor mechanism supported by the tube and imparting an impulse to the first ball to be thrown, under the control of a variator of striking power and an element for regulating the frequency of the impulses, this throwing tube being slidably and pivotally mounted according to two perpendicular axes in a support, so as to be able to regulate the position of the departure point, the initial slope and orientation of the throwing trajectory.

Various other characteristics of the invention will also be revealed by the detailed description which follows.

A form of non-restrictive embodiment of the invention is shown by way of example in the attached drawings.

FIGURE 1 is a longitudinal section of an automatic throwing device, according to the invention.

FIGURE 2 is a section taken along the line II—II of FIGURE 1.

FIGURE 3 is a plane view from above and a cut-away part of the device.

FIGURE 4 is a perspective showing the operating of this device for training a player.

FIGURE 5 is a wiring diagram of a circuit for automatically controlling the ball throwing device.

1 denotes in FIGURE 4 an automatic device for throwing, according to the invention, of a ball 2 over a net 3 towards a player 4 placed at a given point of an area 5, well delimited for playing a game, and in a suitable position for carrying out and repeating a particular stroke. In the example shown, the game considered in a non-restrictive sense is tennis, and the number of strokes of which the player must have the mastery is relatively high, so that the automatic throwing device must be adjustable according to numerous parameters. More particularly, it must be adjustable for height, in orientation on the area 5, in slope in a vertical plane, in the force for striking the ball 2, the number of balls to be thrown one after another, the frequencies of throwing, etc.

A form of embodiment of this automatic device is shown in FIGURES 1 to 3. This device comprises a throwing tube 6 inserted in and supported by a sheath 7 which forms a cylinder around piston 8 and is coaxial therewith. Portion 9 of piston 8 is guided in cylinder 7 and surrounds a compressive spiral spring 10. The latter is interposed between the end 11 of the piston and a threaded plug 12 able to be more or less screwed into an extension 13, shouldered and tapped, of the sheath 7. The ends of the spring 10 are guided in the under-part 9 of said piston and in the tubular wall of the plug 12 whose internal diameters are the same. This plug has a projection in the shape of a milled collar 14 intended to facilitate its screwing into the extension 13 for regulating the initial tension of the spring 10, and hence, its release force.

A magazine 15 is slipped on the sheath 7 and positioned opposite to an opening 16 in this sheath delimited by the cutting and turning back of small tongues 17 and 18 in the breech of sheath 7 (FIGURE 2) fixed by any suitable means on the corresponding side walls of said magazine. This magazine 15 extends outwardly from the axis of the cylinder and is located adjacent the rear portion of the tube 6. In the magazine, balls, whose quantity is limited to the number of identical strokes that must be made one after another, are stored in a zigzag arrangement, as is particularly visible in FIGURE 2. The lowest ball 2*a* drops through the opening 16 into the sheath 7, then is held in the loading chamber of the throwing tube 6 by stopping against a lug 19 extending the latter and against the incurved parts of two elastic buffers 20 and 21 extended and fixed on the small tongues 17 and 18.

This piston 8, forming the striking mass for throwing the ball 2*a*, is integral, in the vicinity of the edge of its under-part 9, with a finger 22 traversing a guiding slot 23 cut in the sheath 7. A cam follower such as a roller 24 loosely mounted on finger 22 exterior to the cylinder 7 cooperates with a cam 25 shaped in a spiral 26 whose end points are connected by a sloping ramp 27.

The cam 25 is keyed on to the output shaft of a motor-reducer unit 28 supported by a plate 29 made integral with the sheath 7 by soldering, for example, of bracing ribs 30. Furthermore, a stop pawl 31 articulated on a pivot 32 of this plate is placed opposite the free end or tooth 33 of the finger 22. The stop pawl 31 is subjected on the one hand, to the action of a spring 34 tending to apply it against a stop 35, a position for which a tooth hook 36 of this pawl is able to maintain the tooth 33 of the finger, and, on the other hand, to the opposing action of an electro-magnet 37. The plate 29 also supports a box 38 of bimetallic switches 39, calibrated so that their respective time constants are different. Each bimetallic switch is capable of being selectively branched by means of a slide contact 40 in series on the feed circuit of the electro-magnet 37 and the field coil of a slow-release relay 41 controlling the feed circuit of the motor-reducer unit 28.

At the beginning of each series of throws, the various elements of the device are in the position shown by the solid lines in FIGURES 1 to 3: the balls 2 to be thrown are stored in the magazine 15 so that the ball 2*a* coming first is placed opposite the throwing tube 6, the initial tension of the spring 10 is regulated by more or less screwing in the plug 12 in function of the range to be reached and the piston 8 occupies the rear position 8*a* corresponding to the start of a throwing movement, a position for which the tooth 33 of the finger 32 of this piston is held by the tooth hook 36 of the pawl 31 and for which the cam 25 is retracted and motionless at 25*a*, so that the nearest point of the shaft of the motor-reducer unit 28 is placed opposing said finger. Furthermore, the slide contact 40 is regulated for branching on the feed circuit of the electro-magnet 37 and the relay 41, of the bimetallic switch 39 whose time constant corresponds to the period selected for the throws.

For starting up a series of throws, the player having taken his place, closes a general switch 50 placed within his reach, controlling the afore-mentioned feed circuit. After a pause, whose duration corresponds to the time constant of the bimetallic switch 39 selected, the electro-magnet 37 is fed and operates against the action of the spring 34 the retraction of the pawl 31 which frees the finger 22. The spring 10 forcibly thrusts the piston 8 which slides in the direction of the arrow F, in the sheath 7 and encounters the ball 2*a* at the position 8*b*. It strikes the latter, from the position 8*b* to the end-of-travel position 8*c* imparting a throwing impulse to it in the selected direction, the ball 2*a* being guided at the commencement of its trajectory by the tube 6. In the end-of-travel position 8*c*, the piston 8 abuts and is stopped by the elastic buffers 20 and 21.

But the field coil of the relay 41 is fed at the same time as the electro-magnet 37 and the time constant of said relay is so determined that the latter can only close the feed circuit of the motor-reducer unit 28 when the piston 8 reaches the end-of-travel position 8*c*. The unit 28 drives the cam 25 which pivots in the direction of the arrow F_1, so that the spiral 26 causes the piston 8 to recoil in the opposite direction to the arrow F, while tightening the spring 10. Furthermore, the relay 41 opens, as soon as it is energized, with a delay corresponding to its time constant, the feed circuit of the electro-magnet 37 controlled by the bimetallic switch selected 39, so that the pawl 31 returns to the position shown in FIGURE 3, appreciably at the instant when the cam 25 is driven. Then, at the end of the return stroke of the piston 8, the end 33 of the finger 22 acts on a slope of the tooth hook 36 of said pawl to retract it, and the latter, returned by the spring 34, again maintains this tooth 33 of the finger after freeing the tooth hook 36.

When the cam 25 has returned to the position 25*a*, the bimetallic switch selected opens the feed circuit of the electro-magnet 37 and the relay 41, the motor-reducer unit 28 stops. Then, after another pause, whose duration corresponds to the time constant of said selected bimetallic switch, a cycle identical with the one described is started for the following ball which has dropped during the return stroke of the piston.

The device also comprises a tripod (not shown), integral with a column 42, vertical and telescopic, able—or not—to be fixed under a frame 43 forming a circular guide for a revolving disc 44 subjected to the action of the locking bolt. This disc has a lug 45 projecting, traversed by a spindle 46 for articulating two cheeks 47 integral with the plate 29 flush with the sheath 7, these cheeks being able to be locked with regard to the disc 44 by means of a nut 48.

The throwing unit supported by said plate 29 can thus pivot in a vertical plane for regulating its slope *a*, pivot in a horizontal plane for regulating its orientation *b* and be placed vertically for regulating its height H.

It results from the foregoing that this automatic device enables balls to be thrown to a player according to a programme chosen by the latter in function of the stroke to be improved. Actually, the player can regulate the height H of the departure point, the orientation *b* of the throwing, the initial slope *a* of the trajectory, the striking force of the ball, the number of balls to be thrown one after another and the rate at which throws take place.

Various modifications can moreover be applied to the forms of embodiment, shown and described in detail, without going outside of the scope of the invention, more particularly with regard to the throwing mechanism which can be the spring 10 periodically tightened by a mechanical motor, or else a compressed air jet, with regard to the element for regulating the rate of throws which can be a clockwork mechanism driven by motive mechanism, with regard to the magazine which can be a detachable loader, etc.

I claim:

1. A device for automatically throwing balls comprising a throwing tube, a cylinder supporting said throwing tube in coaxial relationship, a slidable piston within said cylinder, a coil compression spring within said cylinder acting to force said piston toward said throwing tube, a magazine extending outwardly away from the axis of said cylinder and connected to said cylinder adjacent the rear portion of said throwing tube, an axially directed slot in said cylinder adjacent said piston, a finger portion integral with said piston projecting through said slot, a cam follower integral with said finger portion exterior to said cylinder, a motor driven cam adapted to contact said cam follower to force said piston rearwardly against the force of said coil compression spring and to compress said coil spring, a tooth integral with said finger portion, an electro-magnet controlled stop pawl adapted to grasp said tooth to maintain said piston rearwardly and said coil spring compressed, a relay for stopping and starting said motor, and a bimetallic switch mechanism periodically operated for controlling said electro-magnet to release said tooth and for controlling said relay to operate said motor.

2. Device according to claim 1, wherein said switch mechanism comprises a series of bimetallic switches with different time constants able to be selectively put into service by means of a slide contact for varying the time between throws.

3. Device according to claim 1, wherein the time constant of the relay controlling the motor is so that the relay closes the circuit of the motor only when the piston reaches its extreme position for throwing the ball.

4. Device according to claim 1, wherein the width of said magazine is calculated so that the balls deposited there one on top of the other are in zigzag.

5. Device according to claim 1, in which the breech of the throwing tube has a small tongue at its lower part, accommodating the ball and comprising two elastic stops ensuring the positioning of this ball in alignment with the bore of the throwing tube, said elastic stops also effecting the stopping of the piston at the end of the throwing stroke.

6. Device according to claim 1, comprising a journal screwed into the rear end of the cylinder thereby enabling the compression of the throwing spring to be regulated.

7. A device in accordance with claim 1 wherein said cam follower comprises a roller.

8. A device in accordance with claim 1 comprising universal orientation means in the device support to permit adjustment about horizontal and vertical axes.

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