

Oct. 27, 1942.

R. W. ADAMS

2,299,781

GAME APPARATUS

Filed Sept. 14, 1939

6 Sheets-Sheet 1

Fig. 1

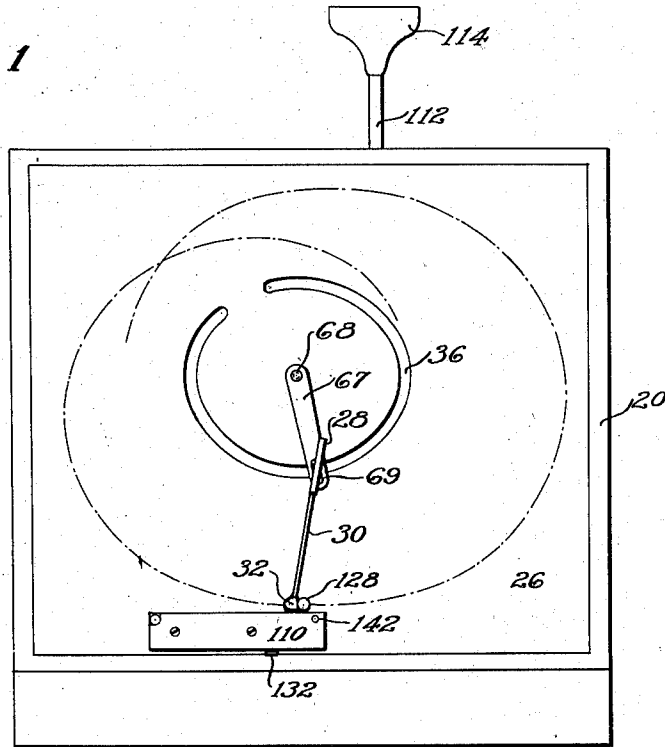
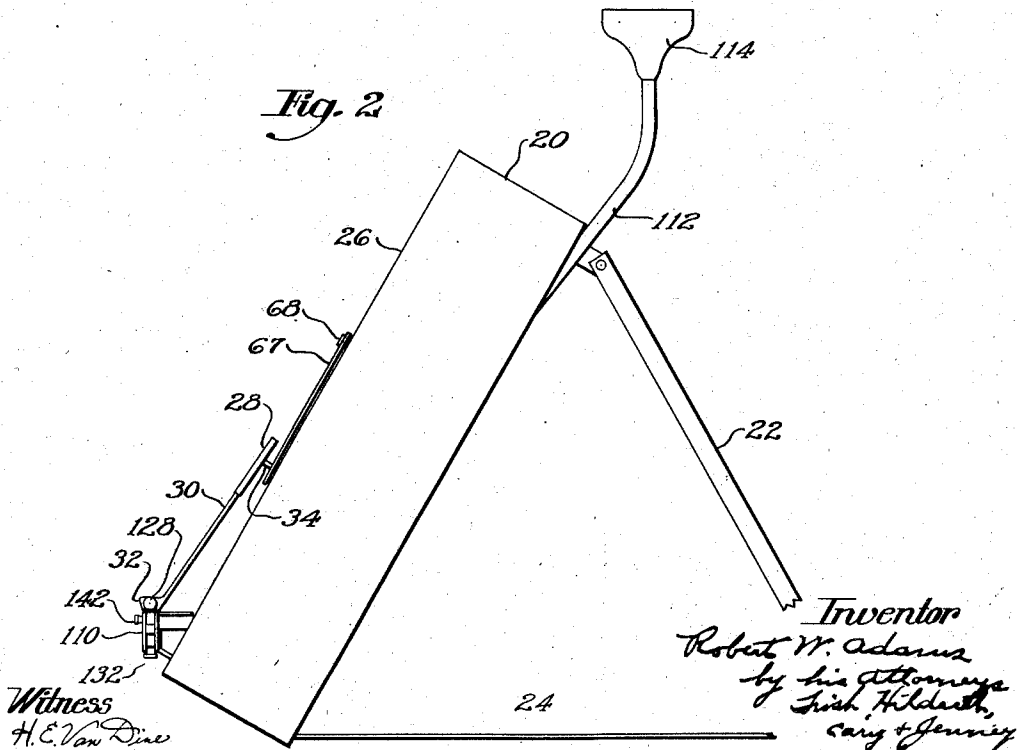


Fig. 2



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6 Sheets-Sheet 2

Fig. 9

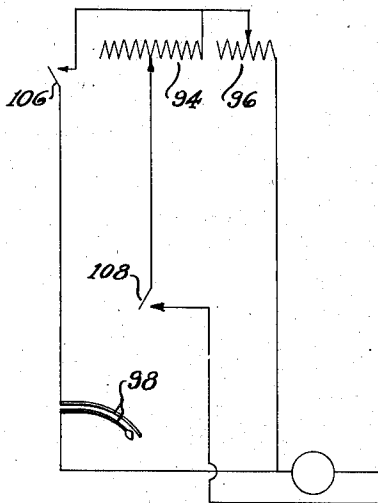


Fig. 3

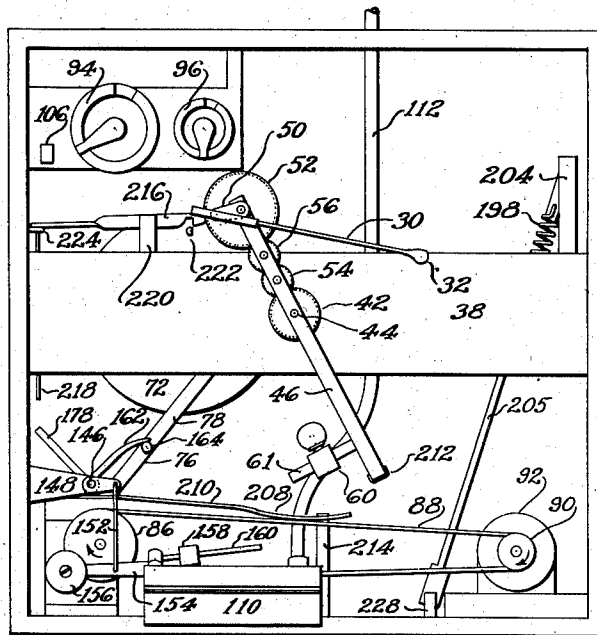


Fig. 10

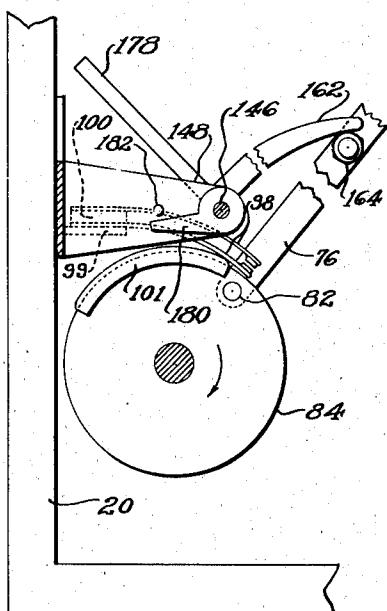
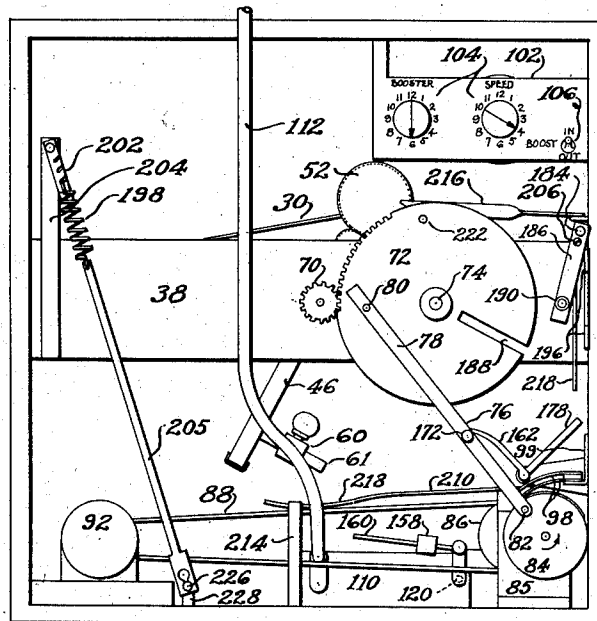
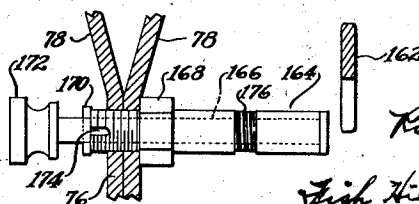


Fig. 4



Witness
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Fig. 11



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Oct. 27, 1942.

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GAME APPARATUS

Filed Sept. 14, 1939

6 Sheets-Sheet 3

Fig. 5

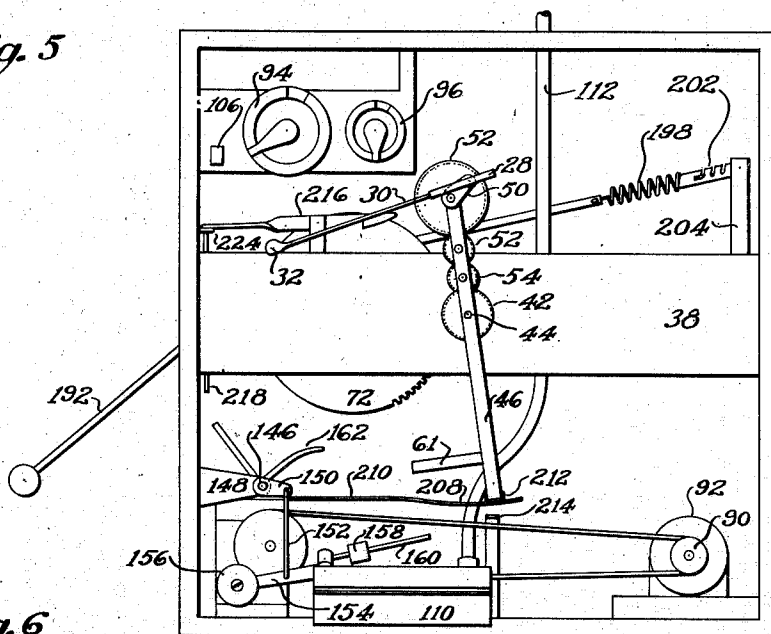
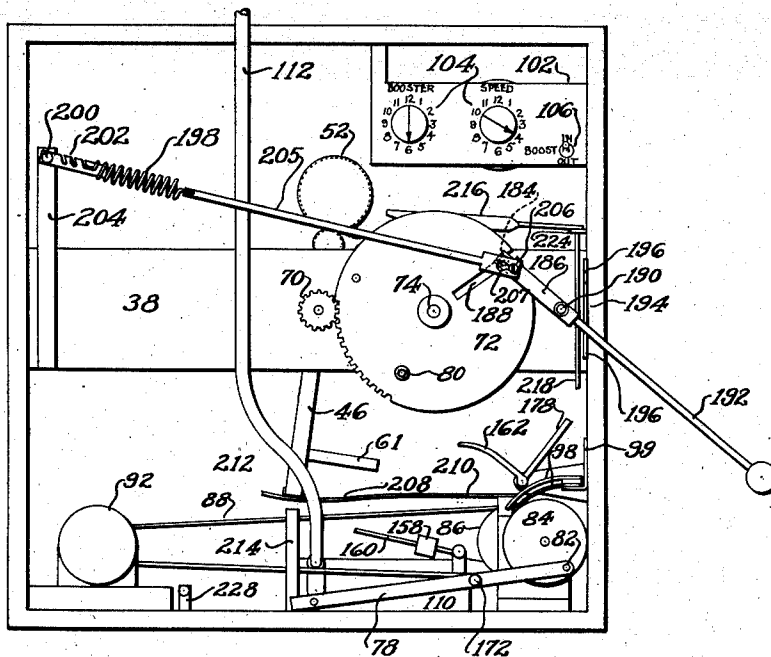


Fig. 6



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2,299,781

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Filed Sept. 14, 1939

6 Sheets-Sheet 4

Fig. 7

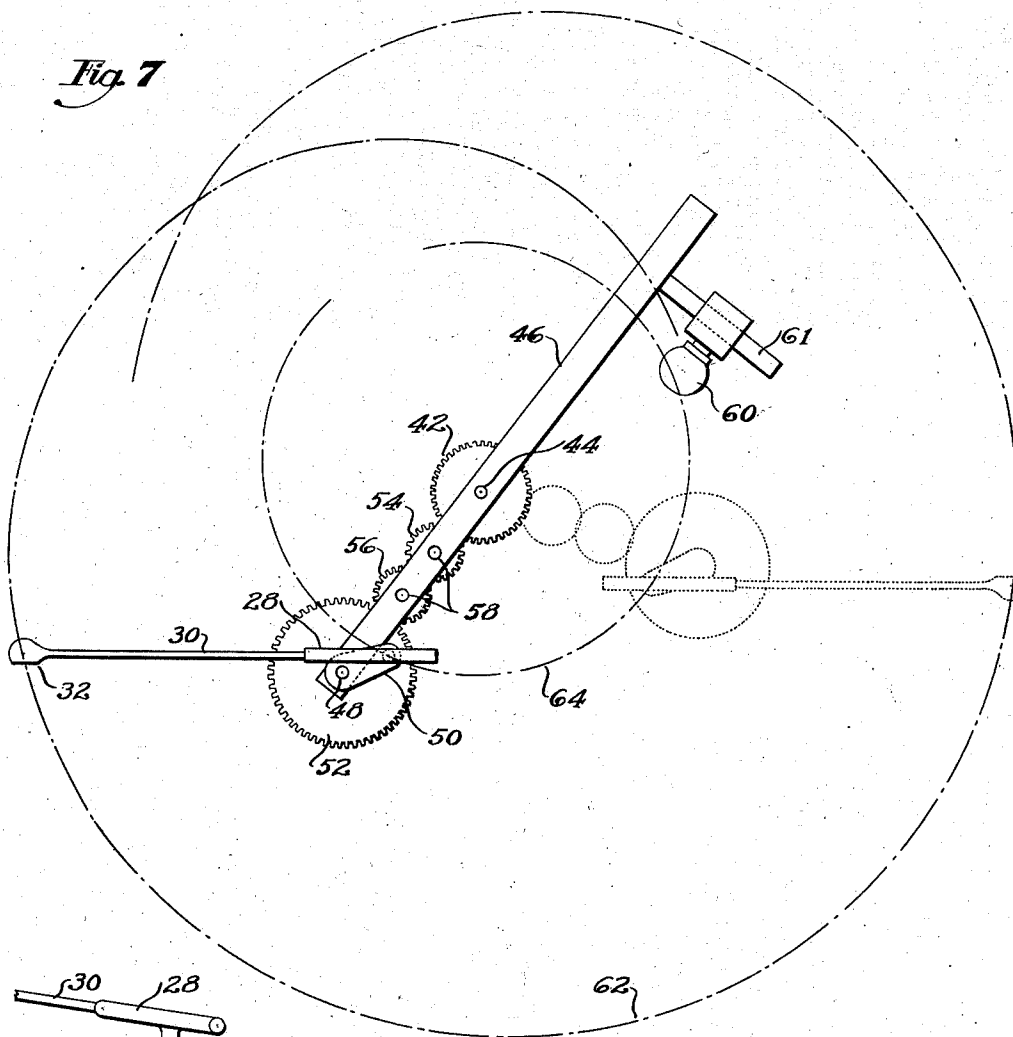
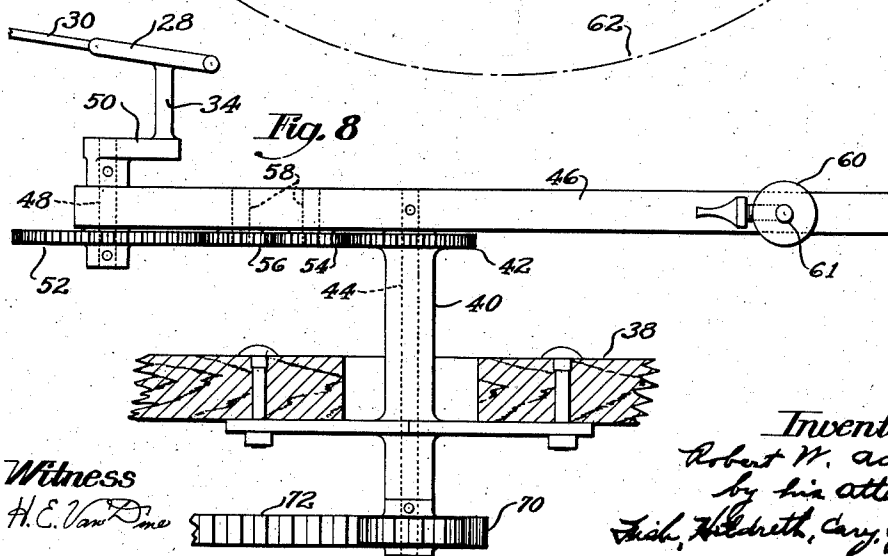


Fig. 8



Witness

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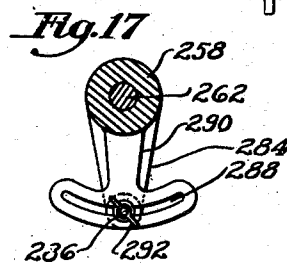
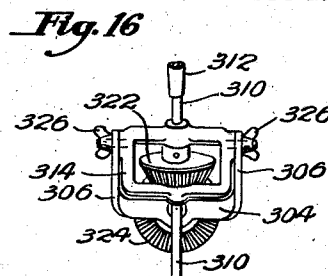
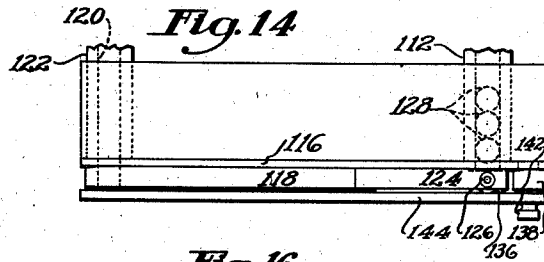
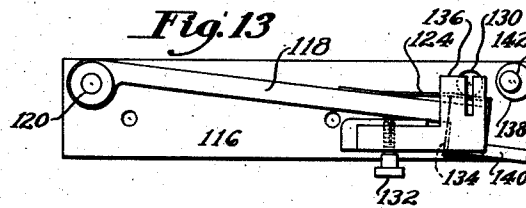
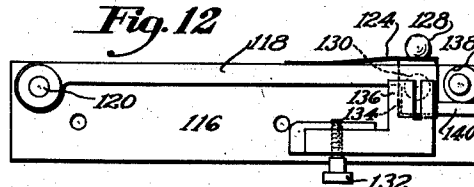
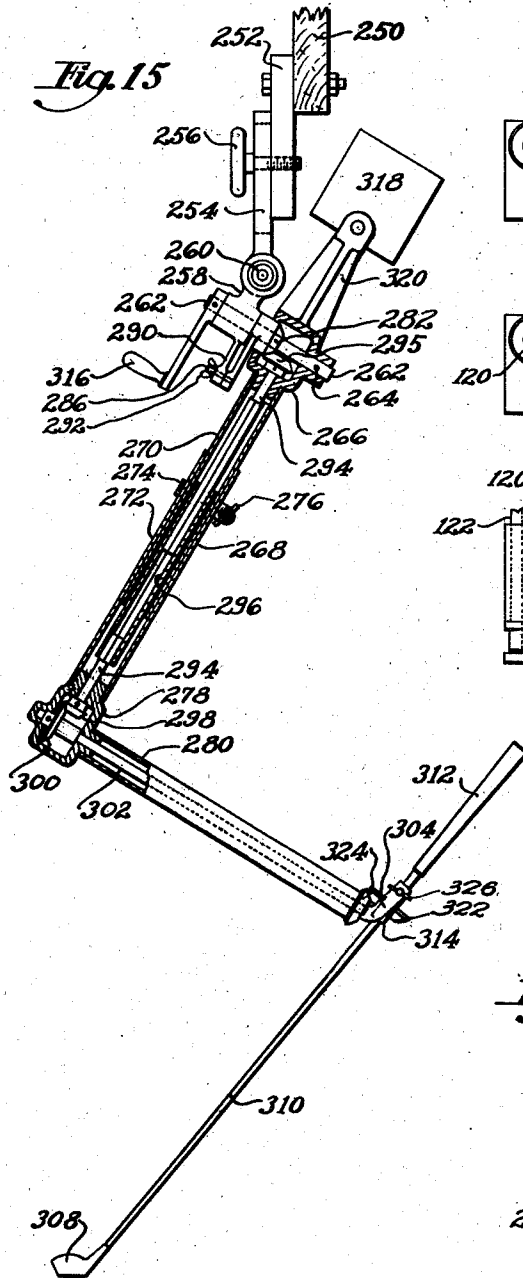
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6 Sheets-Sheet 5



Witness
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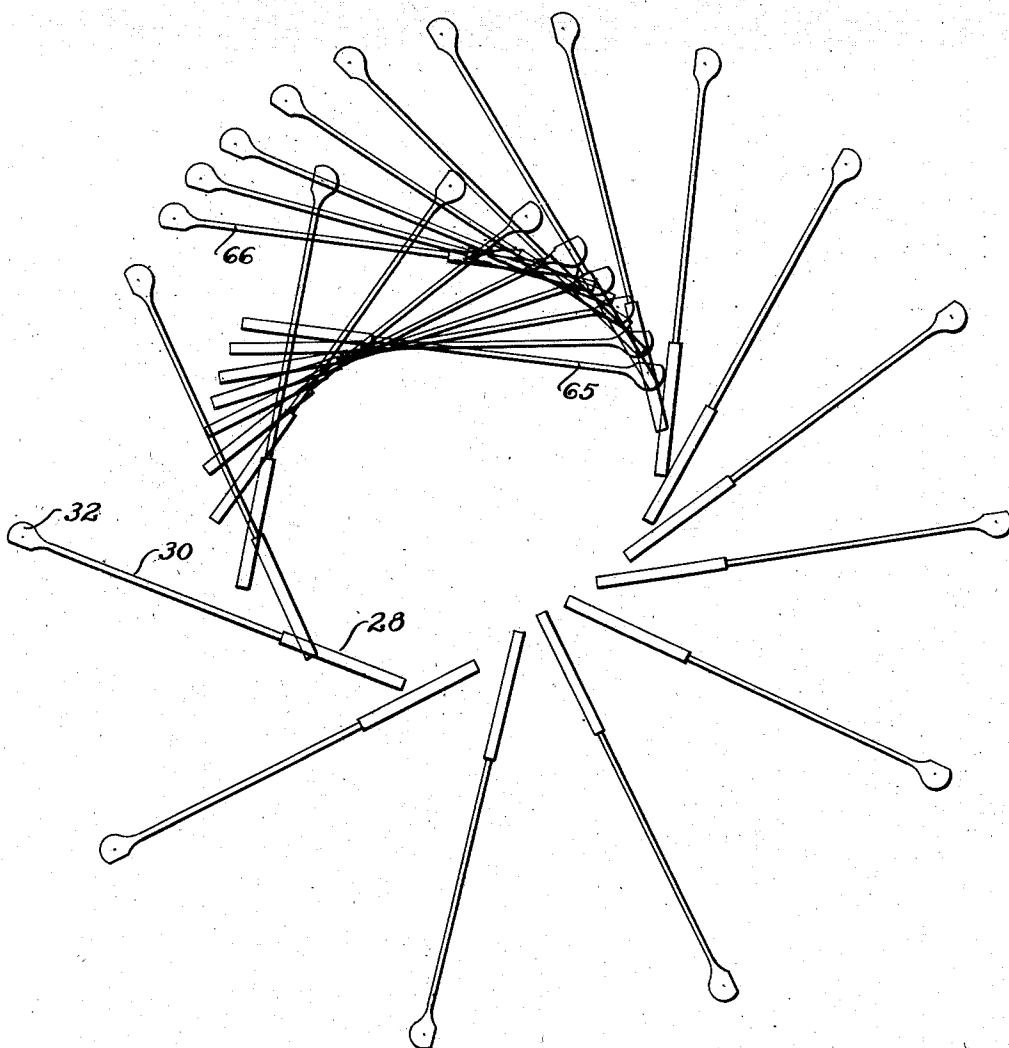
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6 Sheets-Sheet 6

Fig. 18



Witness

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UNITED STATES PATENT OFFICE

2,299,781

GAME APPARATUS

Robert W. Adams, Waban, Mass.

Application September 14, 1939, Serial No. 294,887

23 Claims. (Cl. 273-35)

The present invention relates to game apparatus and more particularly to apparatus for swinging a golf club, either of reduced or full size, in the manner and style of the expert players.

In the game of golf, probably more than in any other game, the proficiency which a player may attain is determined largely by the manner in which he turns his body and swings his arms in making his shots. This is commonly referred to as "form" or "swing," and while the expert players differ in the minor details, practically all of them show the same general characteristics which have come to be recognized as "good form" and are sought to be adopted by the less skillful players.

Owing to the speed of a golf swing in actual playing, it is difficult to understand and analyze the characteristics which go to make good form, and many if not most of the poorer players do not know just what they are really trying to copy and adopt for themselves.

The principal object of the present invention is to provide an apparatus which will reproduce a golf swing in "good form" at any desired speed from normal down to a small fractional part thereof so that all portions of the swing will be clearly shown and may be carefully studied and copied.

A further object of the invention is to provide club swinging apparatus so constructed and arranged that a player or pupil may hold the handle of a club in his hands in the usual way while the club is swung by the apparatus in what is accepted as good form, thus enabling the pupil to experience the "feel" of a good swing even before he is able to produce it by himself, and thereby accustoming his body, arms, and hands to the co-ordination or timing so essential to good play. For such use the apparatus will be equipped with a full size club and will include actuating mechanisms for causing the club to be swung in the manner of the desired swing.

Another object of the invention is to provide a driving machine for testing or demonstrating full size golf clubs and balls under conditions corresponding closely to the actual performance of a "perfect" player.

Still another object of the present invention is the provision of a toy or game device comprising mechanism for swinging a diminutive golf club combined with automatic means for teeing little balls or pellets in position to be driven by the club,

With these objects in view, a feature of the present invention is the combination with a golf club or representation thereof, of means for supporting the same and mechanism for imparting movement to such supporting means and club to cause the same to move in a substantially epitrochoidal path, for I have determined from study and measurements of moving and composite still pictures of a number of well-known expert players, that swings in accepted good form all have the common characteristic of movement of the club head in a generally epitrochoidal path, which is the path traced by a point on the periphery of a wheel or gear or on a radius or a radius prolonged therefrom, rolling without slipping about a fixed gear, such arrangement being commonly described as sun and planet gearing.

Another feature of the invention resides in supporting a club in such manner that a player may grip the handle of the club and be guided by the movement of the club itself as it is moved either by the player or by some external source of power in such epitrochoidal path.

Still another feature consists of means for swinging a golf club embodied with teeing devices for automatically presenting balls to be driven by the club in its swinging stroke.

Other features of the invention will be apparent to those skilled in the art from the following description:

In the drawings illustrating the invention in its preferred form, and an alternative embodiment thereof, Fig. 1 is a view in front elevation of the golf swinging apparatus, showing the club in striking position and with the ball in position to be struck; Fig. 2 is a view in side elevation of the apparatus shown in Fig. 1, showing the apparatus in its rearwardly inclined operating position; Fig. 3 is a view in front elevation of the apparatus of Fig. 1 with the casing erect, the front face thereof having been removed and the club positioned at the beginning of the swing, the parts being arranged for operation from an electric motor or suitable continuously driven source of power; Fig. 4 is a rear view of the apparatus shown in Fig. 3 with the back cover of the casing removed; Fig. 5 is a view in front elevation of the apparatus shown in Fig. 3, but with the mechanism set up for intermittent, manually controlled, spring-driven operation, the club being shown at the finish of the swing; Fig. 6 is a rear view of the apparatus shown in Fig. 5; Fig. 7 is a detail view, on a somewhat larger scale, of the club supporting and actuating mech-

anism for causing the club head to swing an epitrochoidal path, which path is shown in dot-and-dash lines; Fig. 8 is a detail plan view, on a still further enlarged scale, of the club supporting and actuating mechanism shown in Fig. 7; Fig. 9 is a schematic wiring diagram of the electrical circuits for controlling and regulating the swing when the apparatus is motor driven; Fig. 10 is a detail view of the timing switch for producing an accelerated down-swing when the apparatus is motor driven; Fig. 11 is a detail view of the actuating pin for rendering the ball supplying and teeing mechanism operative and inoperative; Fig. 12 is a detail view in front elevation of the ball supplying and teeing mechanism with a ball in position on the tee ready to be struck and with the front cover or protective plate removed; Fig. 13 is a view similar to Fig. 12, but showing the arm in depressed position to receive a ball from the supply tube; Fig. 14 is a detail plan view of the mechanism illustrated in Figs. 12 and 13, with the front protecting plate in place; Fig. 15 is a view in side elevation, partly in section, of an alternative embodiment of the invention, arranged to reproduce, with a substantially full size club, a swing of the desired characteristics when the club is grasped by a person; Fig. 16 is a detail view of the mechanism for supporting and rotating the club of the apparatus shown in Fig. 15; Fig. 17 is a detail view, partly in section, of the adjusting and locking mechanism for the sun gear of the embodiment of Fig. 15; and Fig. 18 is a step-by-step diagram showing the position of the club at various stages throughout a swing as reproduced by the apparatus of the invention.

In the embodiment of the invention illustrated in Figures 1 to 14, the actuating mechanism of the golf swing device is mounted within a supporting case 20, which is adapted to be held at an angle corresponding to the plane of the normal golf swing, approximately 30° from the vertical, by means of a support 22 positioned by a base strap 24. Mounted for swinging movement in the plane of the front face 26 of the device is a golf club comprising a handle 28, a shank 30 and a club head 32. While the golf club may be full size (that of a normal club) it generally will be on a reduced scale for compactness and portability of the apparatus. The club is supported on a pin 34 passing through a curved slot 36 in the front face of the case, the club being connected to the pin at a point on the handle 28 approximating, in proper proportion, the point where the club would normally be held by a player.

To cause the club head, as the club is swung, to travel in a path closely approximating that of a "perfect" golf swing, actuating mechanism including sun and planet gearing is provided. Mounted on the transverse member 38 within the supporting case 20 is a bearing sleeve or housing 40 (see Figure 8) provided at its outer end with a fixed gear 42, hereinafter referred to as the sun gear. A shaft 44 extends through the bearing and has secured to its outer end a radial arm 46, one end of which has pivotally mounted therein a short shaft 48 parallel to the main shaft 44. Secured to one end of the shaft 48 is a crank arm 50, in the end of which is mounted the pin 34 to which the club is connected, while on the other end of the shaft 48 is mounted a gear 52, hereinafter referred to as the planet gear.

To provide the desired spacing between main

shaft 44 and planet gear shaft 48 without requiring the sun and planet gears to be of a size to mesh directly, a pair of idler gears 54 and 56 are provided, mounted on stub shafts 58 secured in the radial arm 46. By employing an even number of idler gears, neither the direction of rotation nor the gear ratio as between the sun and planet gears is changed from that produced by meshing the fixed sun gear 42 and planet gear 52 directly together. The parts are counter-balanced by a weight 60 clamped to a rod 61 extending sidewise from the outer end of the radial arm 46.

By reason of the sun and planet gearing, the path described by the club head, as the radial arm 46 is rotated by the main shaft 44, is an epitrochoid, that being the curve traced by a point on the radius, or (as in the case) radius prolonged, of a circle which rolls without sliding around the circumference of a fixed circle. To cause the club to simulate as closely as possible the swing of the so-called "perfect" stroke, the pitch diameter of the planet gear 52 preferably bears a ratio to that of the sun gear 42 of approximately three to two. As a result, the club, in a swing, makes approximately one rotation about the main shaft 44 and approximately one-half a revolution about the planet gear shaft 48, these separate rotations being cumulative to make a total of one and one-half revolutions of the club from start to finish of the swing. Accordingly, the club is enabled to start and finish in a substantially horizontal position, as in the so-called "perfect" swing.

The position of the club at various stages of a swing is shown in the step-by-step diagram, Figure 18, where the successive positions of the club correspond roughly to successive equal intervals of time, and the path of the club head is represented by the outer dot-and-dash line 62 of Figure 7. This line or path is an epitrochoid, having its axis of symmetry inclined to the vertical in the plane of the swing, the axis of symmetry being the line through the centers of shafts 44 and 48 and the club head 32 when the said three points all lie in the same straight line. The path of the supporting pin 34, which corresponds closely to the path or "swing" of the hands of a player, is likewise an epitrochoid, but has a different axis of symmetry, since the pin lies on a radius extending in a different direction from the planet gear shaft 48 from the radius on which the club head lies. The inner dot-and-dash line 64 of Figure 7 represents the path of pin 34, and the slot 36 in the front face 26 of the supporting case is formed to coincide with this path to provide clearance for the pin.

At the start of the swing, as shown in Figure 18, the club is substantially horizontal, in the position shown at 65. As the shaft 44 is rotated, by mechanism hereinafter described, the club head is caused to travel with increasing velocity, as indicated by the greater spacing between club positions, until the club head is at the bottom, in striking position. Since the axis of symmetry of the epitrochoidal path of the club head is inclined to the vertical, the handle 28 of the club is in advance of, or "leads" the club head 32 from the start of the stroke up to and even somewhat beyond the position of the club when at the bottom of its swing, the club head thereafter overtaking the lead of the handle on the follow-through to final stopping position 66 (see Fig. 18).

To simulate roughly the arms of a player so

as to illustrate the angle of the club with the arms at various stages of a swing, an indicating member 67 may be mounted on the front face 26 of the case on a pivot 68 located at the approximate center of the curved slot 36 cut for the club supporting pin 34. The other end of the link 65 is provided with a slot 69 to receive the pin 34 so that the link is swung thereby as the club is swung, the slotted connection permitting relative longitudinal movement of pin and slot, due to the eccentricity of the pivot 68 with respect to the curvature of slot 36. Figure 1 illustrates the way the link 67 simulates the "lead" of the hands at the instant the ball is struck.

As an additional refinement to approximate still more closely the ideal swing at the start and finish of a stroke, the club is caused to assume a somewhat lower position 65, at the beginning of the swing, than the final stopping position 66 at the end of the swing. This is accomplished by reason of the fact that the club shaft and handle do not lie on the radius which passes through the club head from the planet gear shaft 48 as shown in Figure 7, since the line of the club handle and shaft, as shown in the full line position of the downswing, passes above the center of shaft 48, while on the follow-through shown in dotted line, the line of the club shaft is below the center of shaft 48. Since the club, in each of these positions, is rotated approximately 180° from its positions at the start and finish, it is apparent that the finish position 66 at the end of a swing is above that at the beginning 65, as shown in Figures 3, 5 and 18.

The club is caused to be swung by actuating mechanisms which may be operated manually or by means of an electric motor to produce a slow or a fast swing, an accelerated swing, or a succession of swings. To this end, the main shaft 44 has secured to its inner end a gear 70 which meshes with a gear 72 several times larger than the gear 70 and pivoted on a stub shaft 74 mounted on the transverse support 38.

In motor operation, as shown in Figs. 3 and 4, the gear 72 is rocked through a partial revolution, sufficient to rotate the main shaft 44 through substantially a full revolution, by means of a link 76 having yoke arms 78 pivotally connected to a pin 80 extending on each side of the gear 72. The link is reciprocated by a crank pin 82 on a disk 84 secured to the low speed shaft of a speed reducer 85. The high speed pulley 86 of the speed reducer is driven by a belt 88 from the driving pulley 90 of an electric motor 92. The club, as long as the motor runs, swings back and forth between the limits of its swing, in its epitrochoidal path closely approximating the ideal golf swing.

The speed of the swing may be readily controlled by means of a rheostat 94 connected in series with the motor circuit (see Figure 9), the motor being of the "universal" or series-wound type provided with a commutator to permit operation on either alternating or direct current. The device is likewise arranged to produce a swing wherein the club starts the downstroke relatively slowly, accelerates to maximum velocity as the club reaches hitting position and then decelerates to final position, returning at slow speed to starting position in much the same manner as a player making a series of practice swings. This is accomplished by means of a supplementary circuit arranged, at a predetermined

point in the club swing, to short circuit a rheostat 96 in series with the main rheostat 94.

This supplementary circuit comprises a pair of normally open contacts 98, mounted on a bracket 99 with a spacer of insulation 100, the contacts being adapted to be closed by a raised segment 101 on the periphery of the crank disk 84. The segment 101 is positioned with respect to the crank pin 82 so that the contacts are closed to short circuit the rheostat 96 and thereby to increase the speed of the motor at a point in the swing of the club soon after the club has started its downward stroke. Due to the inertia of the parts, the club appears to accelerate in an entirely natural manner up to hitting position, after which point the segment passes by the points to open the same and slow down the motor by including the rheostat 96 in series with rheostat 94.

The controlling rheostats are mounted on a panel 102 at the rear of the case, control knobs and graduated scales being provided for adjusting the resistance values. A switch 106 permits the accelerating circuit to be connected or disconnected as desired, while a main switch, indicated at 108 in Figure 9, serves to turn the motor on and off.

For demonstrating the effectiveness and uniformity of the swing, and to enable the apparatus to be used as a game or an amusement device, mechanism is provided for supplying small size balls or pellets to be struck or driven by the club. These balls, which may be of Celluloid or other appropriate material, are of a size commensurate with the size of the club, and are supplied by gravity to the automatic teeing mechanism, indicated generally at 110 in Figs. 1 and 2, through a tube 112 from a hopper 114 above and to the rear of the case 20.

The teeing mechanism, best illustrated in the detail views, Figs. 12 to 14, is mounted on the case 20 directly below the path of the club swing, and is positioned at an angle to the front face of the case (see Figure 2) so that the ball supporting surface is substantially horizontal when the plane of the club swing is at the proper angle to the vertical. The mechanism comprises a supporting side plate 116 and an arm 118 adapted to be rocked vertically in front of said plate through a small angle, the arm being secured to a shaft 120 extending rearwardly through a bearing 122 carried by the plate 116.

The arm 118 is provided at its other end with resilient ball supporting means comprising a strip of spring material 124 such as thin Phosphor bronze, the strip being secured at one end to the arm and free of and spaced from the arm at its other end. A shallow recess or depression 126 in the strip 124 serves as a seat or "tee" for the ball 128, the strip yielding downwardly when the ball is struck to permit the ball to leave the "tee" in the direction of the drive without being deflected by the edge of the seat.

The balls are supplied to the tee through an aperture 130 in the plate 116, the supply tube 112 being connected to this aperture. The inside diameter of the tube and aperture is just large enough to afford free passage to the balls, while maintaining them in a single line, as shown in Figure 14.

When the arm 118 is lowered by mechanism hereinafter described, the strip 124 is positioned in line with the bottom of the aperture 130 to permit a ball to roll by gravity from the tube

onto the strip, where it drops into the shallow recess 125. A thumb screw 132 permits adjustment of the heightwise position of the strip relative to the aperture when the arm is lowered. The balls are held within the tubing, as the arm is raised, by a downwardly projecting portion 134 of strip 124, which portion serves as a gate to cover the aperture except when the arm is in lowermost position. A vertically grooved abutment 136 prevents the ball, when the arm is in ball receiving position, from rolling off the tee under the urging of those following, and likewise guides the ball while the arm is being rocked to raise the teed ball to driving position. The heightwise position of the ball when the arm is raised is adjusted for proper presentation to the face of the club head by an eccentric 138 which serves as an adjustable abutment for the offset end 140 of the arm 118. A knob 142 projecting from the front face or cover plate 144 of the teeing mechanism enables the eccentric to be rotated to the desired setting.

The arm is rocked to supply a teed ball after the club has passed the low point on the return swing, and in time to be struck by the club on the forward swing. This is accomplished automatically by connections actuated by and in timed relation to the crank disk 84 of the speed reducer. These connections (see Figs. 3 and 5) comprise a rock shaft 146 mounted on a bearing bracket 148 secured to the case 20 above the speed reducer 85, the shaft having secured to its forward end an arm 150. The arm is connected by a flexible link 152, such as a length of cord, to a lever 154 secured to the inner end of the shaft 120 of the tee arm 118. A weight 156 secured to the end of the lever 154 tends to maintain the tee in raised position, a counterweight 158 being adjustable along rod 160 to a position where the weight 156 is only just sufficient to raise the tee and ball to hitting position.

The rock shaft 146 is rotated in counter-clockwise direction, as viewed in Figures 3 and 5, to lower the tee to ball-receiving position by means of an arm 162 secured to the inner end of the shaft and adapted to be engaged by a roll 164 carried by a pin 166 extending from the link 76 (see Figures 4, 10 and 11). The pin is slidably received in a bushing 168 secured in the link to permit the roll 164 to be moved out of the plane of the arm 162 if it is desired to stop the supply of balls while continuing the swinging of the club. The position of the roll transversely of the link 76 is determined by a cross bar 170 extending through the pin 166 and adapted to bear against the end of the bushing 168, as shown in Fig. 11, to hold the roll out of the plane of the arm. By rotating the pin by means of knob 172, the bar may be aligned with slot 174 in the bushing to permit the pin, under the urging of spring 176, to slide through the bushing lengthwise thereof and thus bring the roll into the plane of the arm 162 for actuation thereby. The arm 162 is counterbalanced by a lever 178 extending substantially at right angles thereto and serving as a hand lever to permit manual operation of the ball supplying mechanism. A lever 180 on the rock shaft 146 limits the clockwise rotation of the shaft to the proper amount by engagement with a stop pin 182 on the bracket arm 148.

The swinging apparatus is likewise arranged to permit the club to be swung by a spring, or by a hand lever, in order to study certain por-

tions of the swing as desired. For this purpose, the yoke arms 78 of the links 76 are sprung outwardly to disconnect them from the ends of pin 80, after which the link may be lowered to rest on the bottom of the case as shown in Figure 6. The gear 72 is then rotated to a position in which a pin 184 mounted on one end of a lever 186 may be slipped into a radial slot 188 cut in the body of the gear. The other end of the lever 186 is pivoted at 190 on the transverse support 38, and is provided with a socket into which one end of a hand lever 192 may be threaded. A fixed plate 194 having abutments 196 limits the raising and lowering of the handle to an amount which produces the proper extent of club swing.

For spring driven operation, a tension spring 198 is provided, pivotally connected at 200 through a notched adjustment member 202 to a support 204 secured to the transverse member 38. The outer end of the spring is connected by means of link 205 to a headed pin 206 on lever 186 adjacent the slot engaging pin 184, the end of the link having a keyhole aperture 207 to permit passage of the head of the pin 206 therethrough. Since the tendency of the spring is to align the lever 186 with the pivots 200 and 190, the spring tends to accelerate the club on the downswing and to decelerate the club on the follow through, the decelerating force being somewhat the stronger by reason of the fact that the club and actuating gearing pass beyond the vertical at the end of the swing (see Fig. 5).

When the club is spring actuated, a friction brake is provided for bringing the mechanism to rest without shock at the end of a swing. The brake comprises an arcuate portion 208 of a yielding arm 210 adapted to bear against a tip or pad 212 of friction material on the end of radial arm 46 as the arm approaches the end of the follow through portion of the stroke. The brake, for other than spring actuation of the club, is held out of engagement with the arm 46 beneath a catch 214 secured to the case 20. The counterweight 60 is preferably removed from the radial arm when the spring 198 is employed, so that the weight of the parts may assist in accelerating and then decelerating the club as the stroke is made.

To retain the club in starting position against the force of the spring 198, a latch 216 is provided which may be released by a pull on cord 218 to start the swing. The latch is pivoted on a bracket 220, and is notched to engage a pin 222 extending from one face of the gear 72 (see Fig. 3). Except when in latched position, the latch rests on a stop 224 out of engagement with the pin 222 so as not to interfere with the free rocking movement of gear 72 when hand or motor driven. The spring actuating mechanism, when disconnected from the gear, is likewise held out of the way by slipping the apertured end of link 205 over a pin 226 mounted in a bracket 228 fastened to the case 20.

For instructing a player in the "feel" of a swing made in good form, there is provided, in accordance with another feature of the invention, the apparatus illustrated in Figure 15. In this embodiment, the club is full-sized, and is supported and arranged at the proper height and angle so that the handle or grip may be grasped by the player while assuming the conventional position or stance. Through connections hereinafter described and similar in principle to those of the first described embodiment, the club

is caused to travel in the so-called "perfect swing" or path as the player grips the club, the player through repeated swings thereby acquiring a "feel" of the proper movements which produce a swing in good form.

The swinging apparatus may be supported in any convenient manner, the arrangement of Figure 15 involving the use of an overhead beam 250 or the like as the supporting element to avoid interference with the swing of the club. A bracket 252 and a vertically slotted hanger 254 secured to the bracket by a clamping screw 256 permits vertical adjustment of the apparatus for various lengths of clubs and players of different heights.

The golf club swinging assembly is carried by a bearing member 258 pivotally mounted on a cross shaft 260 in the lower end of the hanger 254 to permit variation and adjustment of the angular position of the plane of the swing with the vertical. The main supporting shaft 262 is pivotally received in the bearing 258 and has secured to one end by means of pin 264 a housing member 266 forming the upper end of a hollow arm 268 extending radially from the shaft 262. The arm is adjustable in length by reason of telescoping upper and lower sleeves 270 and 272 which are held in adjusted relation by a clamping ring 274 tightened by thumb nut 276.

A second housing member 278 secured to the lower end of sleeve 272 provides a right angle connection for a second hollow arm 280 with the radial arm 268, the arm 280 being arranged in substantially parallel relation to the main supporting shaft 262.

The actuating mechanism for the swinging apparatus comprises a bevel gear 282, hereinafter called the sun gear, which is pivotally mounted on the shaft 262 with the gear teeth extending within the housing 266. To lock the gear in fixed position relative to the bearing 258 while permitting the setting of the gear to be adjusted for a purpose that will hereinafter appear, the gear 282 is provided with a radial arm 284 having a threaded stud 286 extending through an arcuate slot 288 in an arm 290 depending from the bearing member 258. By tightening wing nut 292 on stud 286 the gear may be rigidly secured against rotation.

Journalled in the telescoping radial arm 268 is a shaft 294 having at its upper end a bevel gear 295 meshing with the sun gear 282. The shaft 294 is in two parts, with adjacent ends squared and slidably received within an internally squared sleeve 296 to provide a telescoping connection adjustable with the arm. A bevel gear 298 is secured to the lower end of the shaft within housing 278. Meshing with the gear 298 is a bevel gear 300 secured on a shaft 302 journalled in the arm 280 parallel to main shaft 262. The shaft 302 extends slightly beyond the end of the arm and carries a yoke 304 having spaced depending arms 306.

The golf club carried by the apparatus may be of conventional dimensions, having a head 308, shaft 310 and handle 312. The club is connected to the apparatus by means of a rectangular frame or yoke 314 in which the club shaft 310 is rotatably mounted. The frame 314 is pivotally connected to the lower ends of the arms 306 to permit the angular position of the club to be adjusted with relation to the arm 280.

As in the first described embodiment of the invention, the club makes one-half a revolution about its supporting shaft 302 while the latter

is making a whole revolution about the main shaft 262, the club thus making a total of one and one-half revolutions for one revolution of the supporting arm 268. This is accomplished by

- 5 a suitable selection of ratios for the bevel gears of the driving connections. In the illustration, the gear at the upper end of shaft 294 is shown as the same size as the sun gear 282, while the gears 298 and 300 have the two to three ratio.
- 10 Any suitable equivalent arrangement may be employed, however, to produce the desired ratio of rotations.

The swinging apparatus is adapted for use wherein a player grasps the handle of the club, assumes the correct position or stance, and then swings the club, the apparatus of the invention causing all parts of the club to move in the proper path for a "perfect form" swing. Instead of the player swinging the club, the mechanism may be actuated externally by means of hand crank 316 secured to the main supporting shaft 262. In either case, a suitable counterpoise device will be provided such as a weight 318 carried by an arm 320 extending in the opposite direction from radial arm 268 to counterbalance the weight of the club supporting mechanism and thus permit the apparatus to be easily operated.

By providing an adjustment for the setting of the sun gear 282, as above described, the axis of symmetry of the epitrochoidal path of the swing may be varied with relation to the vertical. While an inclination of approximately 30° has been found typical of many players' swings, certain players may be better suited by a swing having an axis of symmetry of a slightly different angle. The proper setting of the sun gear may be found in such cases by experiment.

If desired, the clamping nut 292 may be loosened to free the sun gear. The player may then swing the club and observe, by the variation in position of the sun gear throughout the swing, how close his swing approaches the desired swing, which would result in no movement of the sun gear.

As a further refinement in the embodiment of Figure 15, means are provided for positively rotating the club about its own shaft as an axis, in order to acquaint the player with the proper wrist action as the swing is made. This is accomplished by providing a bevel gear 322 secured to the club shaft 310 and meshing with a bevel gear 324 fixed to the end of arm 280. The gears may be of a size to provide a ratio of approximately one to one. As the club rotates about the arm 280 in a swing, the gear 322 is rotated to cause the club to turn in its supporting frame or yoke 314. Since the pivot points for the frame 314 are at the end of arms 306 and lie on a line normal to the line of intersection of the gear teeth and extending through the zone of such intersection, the gear teeth of bevel gears 322 and 324 remain in mesh over considerable variations in angular position of the club with the arm 280.

While in the accompanying drawings and foregoing description there has been shown and described what is now considered to be the preferred embodiment of the present invention together with an alternative form thereof, it is to be understood that the invention is not limited thereto, but shall be deemed to include other forms and arrangements except within the scope of the appended claims.

Having thus described the invention, I claim:

1. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and devices operating when the arm is turned upon its pivot to impart turning movement in the same direction to the club upon the arm to cause the club to swing in a path approximating that imparted to a club by a player, said devices being operative throughout a club swing of at least 180°.

2. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm and transversely thereof to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and devices operating when the arm is turned upon its pivot for turning the club upon the arm in the same direction to impart an epitrochoidal path of movement to the head of the club, said devices being operative throughout a club swing of at least 180°.

3. A golf club swinging apparatus having, in combination, a pivoted arm, means for turning the same, devices for pivotally supporting a golf club upon the arm to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and mechanism actuated by the turning of the arm upon its pivot and operative throughout a club swing of at least 180° for turning the club to impart an epitrochoidal movement to the head thereof.

4. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm and transversely thereof to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and means including a fixed gear concentric with said pivotal axis of the arm, and a second gear rigidly connected to the club supporting means and in operative connection with the fixed gear for imparting movement to the club head in substantially an epitrochoidal path.

5. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm and transversely thereof to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and devices for imparting rotative movement to the club supporting means at a higher rate of rotation than of the arm to cause movement of the club head in approximately an epitrochoidal path.

6. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and devices for causing the club to rotate through approximately one-half a revolution relative to the arm when the arm is rotated through substantially a complete revolution.

7. A golf club swinging apparatus comprising a fixed support, a member rotatably mounted on the support and comprising two hollow arms in fixed angular relation to one another, shafts rotatably mounted on the arm and geared together, means for securing the club to one of the shafts, means for rotating the member, and connections for rotating the shafts when the member is rotated.

8. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally

supporting a golf club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, and actuating connections for turning the club on the arm when the arm is turned on its pivot to cause the club head to describe an epitrochoid having an axis of symmetry inclined to the vertical in the plane of the swing.

9. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm to permit the club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, devices for turning the arm upon its pivot and for turning the club upon the arm to impart an epitrochoidal path of movement to the head of the club, and means for rotating the club about its longitudinal axis as the club is turned upon the arm.

10. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, actuating connections comprising sun and planet gearing for turning the club on the arm when the arm is turned on its pivot to cause the club head to describe a substantially epitrochoidal path, and means for adjusting the position of the sun gear relative to the arm to vary the position of the axis of symmetry of said epitrochoid.

11. A golf club swinging apparatus comprising a fixed support, a shaft rotatably mounted thereon, an arm fixed upon said shaft, golf club supporting means pivotally mounted on the arm, and means for rotating the arm on its support and the club upon the arm, said means comprising a continuously rotating source of power and actuating connections for rocking the shaft to swing the club through substantially a full stroke.

12. A golf club swinging apparatus having, in combination, a fixed support, an arm rotatably mounted on the support, means for pivotally supporting a golf club on the arm to permit the club to turn about an axis parallel to and spaced from the pivotal axis of the arm, mechanism for turning the club upon the arm when the arm is turned on its pivot for causing the club to swing in a path approximating the swing imparted to the club by a player, means comprising a continuously rotating source of power and actuating connections for rocking the arm to swing the club through approximately one and one-half revolutions, and devices for causing the club to swing at a faster rate on the down-swing than during other portions of the swing.

13. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, and means comprising a continuously rotating crank and a link reciprocated thereby for rotating the shaft first in one direction and then in the other to cause the golf club to swing back and forth.

14. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, and means for rotating the shaft first

in one direction and then in the other to cause the golf club to swing back and forth, said means comprising a driven gear on the shaft, a driving gear at least twice the diameter of the driven gear for driving the latter, a continuously rotating crank, and a link connecting said crank with the driving gear to rock the same through less than a half revolution while causing the shaft to rock through more than a half revolution.

15. A golf club swinging apparatus having, in combination, a fixed support, an arm rotatably mounted on the support, means for pivotally supporting a golf club on the arm to permit the club to turn about an axis parallel to and spaced from the pivotal axis of the arm, mechanism for turning the club upon the arm when the arm is turned on its pivot for causing the club to swing in a path approximating the swing imparted to the club by a player, means comprising an electric motor and actuating connections for rocking the arm to swing the club, and devices for accelerating the speed of the motor during the down-swing of the club comprising an electric resistance element connected in series with the electric motor and a pair of normally-open electrical contacts connected across the resistance and adapted to be closed during a portion of the club swing and in timed relation thereto to short-circuit the resistance and thereby increase the speed of the motor.

16. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, and means for rocking the shaft to swing the club comprising a driven gear on the shaft, a driving gear larger than the driven gear for driving the latter, a manually operable lever, and pin and slot connections between the lever and the driving gear for rocking the same to swing the club.

17. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, and means for rocking the shaft to swing the club including a spring for accelerating the swing of the club during the down-swing and tending to decelerate the club during the finish of a swing.

18. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, and means for rocking the shaft to swing the club including a spring for accelerating the swing of the club during the down-swing and tending to decelerate the club during the finish of a swing, the force of the spring tending to decelerate the club during the finish of a swing being less than the accelerating force imparted to the club on its downswing whereby the club may finish the stroke in raised position.

19. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, means for rocking the shaft to swing the club including a spring for accelerating the swing of the club during the down-swing and tending to decelerate the club during the finish of a swing, and friction braking means operative during the finish of a swing to bring the arm to rest and retain the same at the limit of the club swing.

20. A golf swinging apparatus having, in combination, a fixed support, a shaft rotatably mounted therein, an arm secured to the shaft for rotation therewith, a member pivotally mounted on the arm and having a golf club secured thereto, connections for causing the member to rotate on the arm when the shaft is rotated, means for rocking the shaft to swing the club including a spring, and releasable latching means operative to retain the arm with the club in starting position at the top of the swing.

21. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm for turning movement about an axis parallel to the axis of the arm, said axes being spaced a distance approximating the length of the club from its head to its pivotal axis, and devices operating when the arm is turned on its pivot to impart turning movement to the club relative to the arm to cause the club to swing in a path approximating that imparted to a club by a player throughout a swing of at least 180°.

22. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club upon the arm for turning movement about an axis parallel to the axis of the arm, said axes being spaced a distance approximating the length of the club from its head to its pivotal axis, and devices coordinating the relative turning movements of club and arm for causing the club to turn through approximately one and one-half revolutions when the arm is turned through substantially one revolution.

23. A golf club swinging apparatus having, in combination, a pivoted arm, means for pivotally supporting a golf club to turn about an axis parallel to the pivotal axis of the arm and spaced therefrom, the golf club being supported with the handle portion thereof to one side of the axis of the pivotal supporting means, and devices comprising sun and planet gearing for coordinating the relative turning movements of the club and arm, said gearing having a ratio such that the club turns through approximately one and one-half revolutions when the arm is turned through one revolution, whereby the club head is caused to move in a substantially epitrochoidal path approximating the swing of a player, with the club, at the beginning of a swing, lying in a substantially horizontal plane slightly below the plane of the club at the finish of a swing by reason of said offset of the club handle relative to the axis of the pivotal supporting means.

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