Jan. 8, 1952 E. E. WILLIAMS 2,581,738

GOLF GAME

Filed Feb. 18, 1948 4 Sheets-Sheet 1

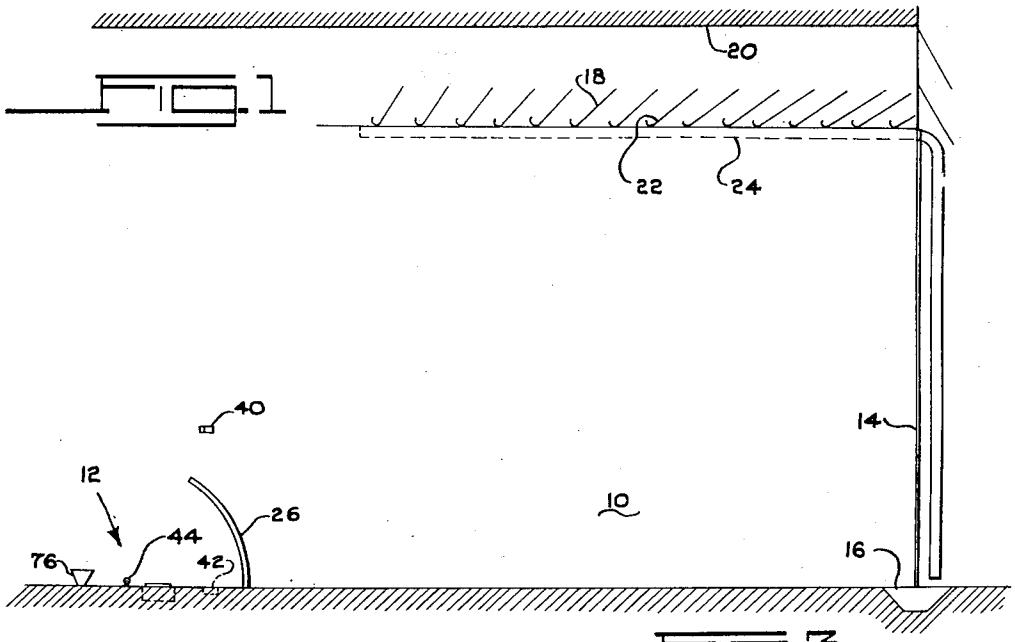


FIG. 1

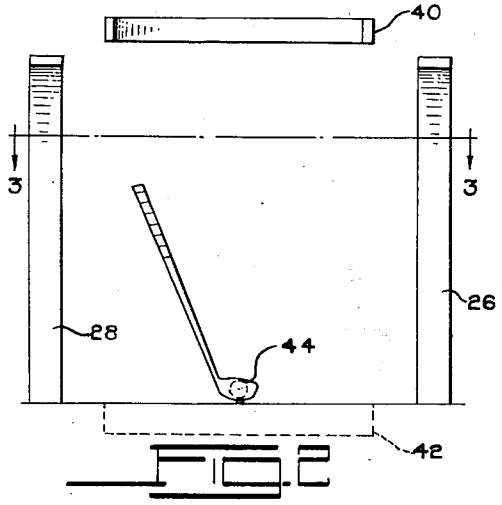


FIG. 2

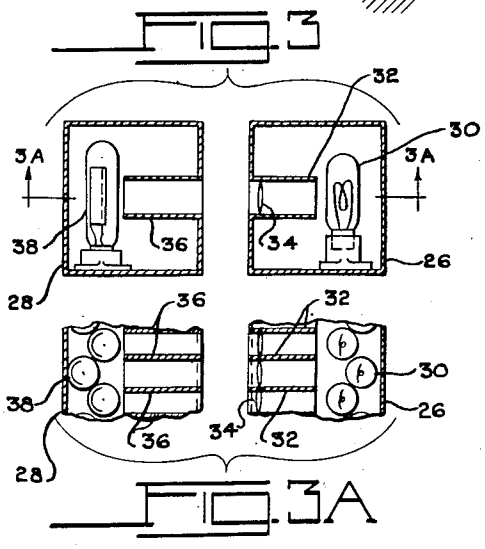


FIG. 3A

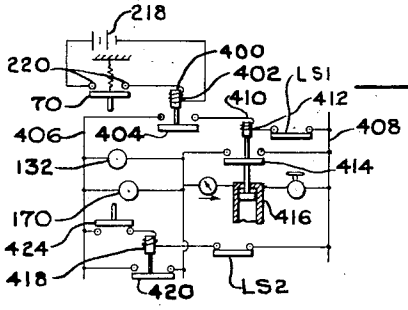


FIG. 2C

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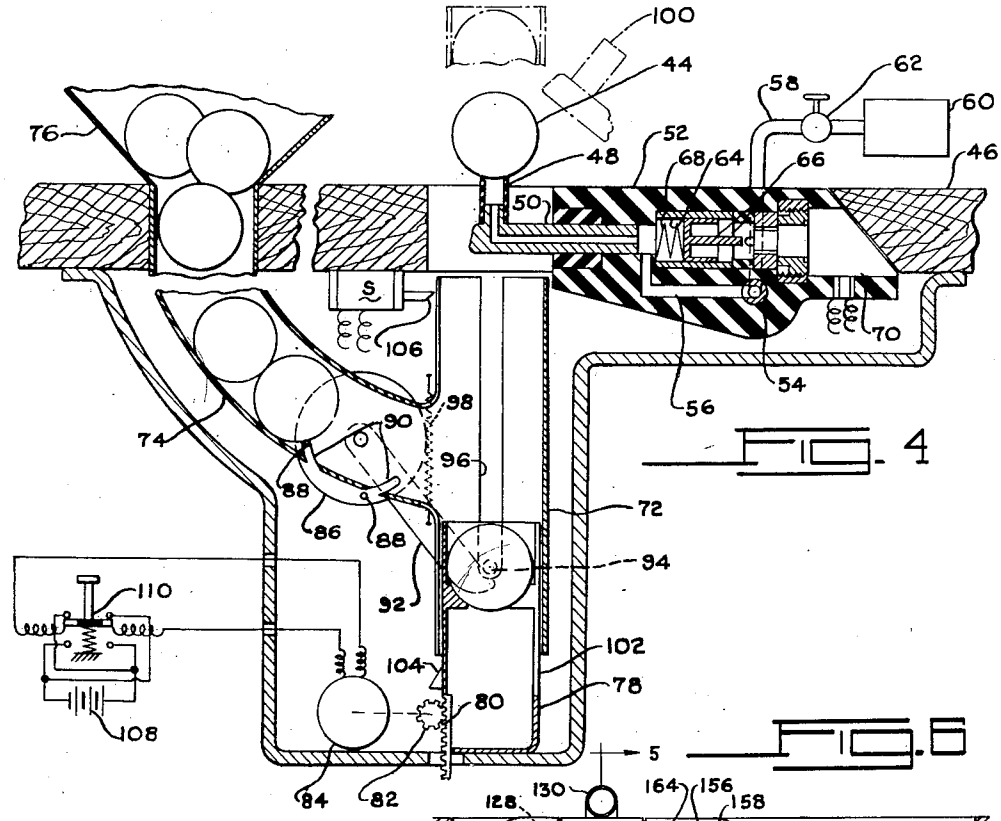
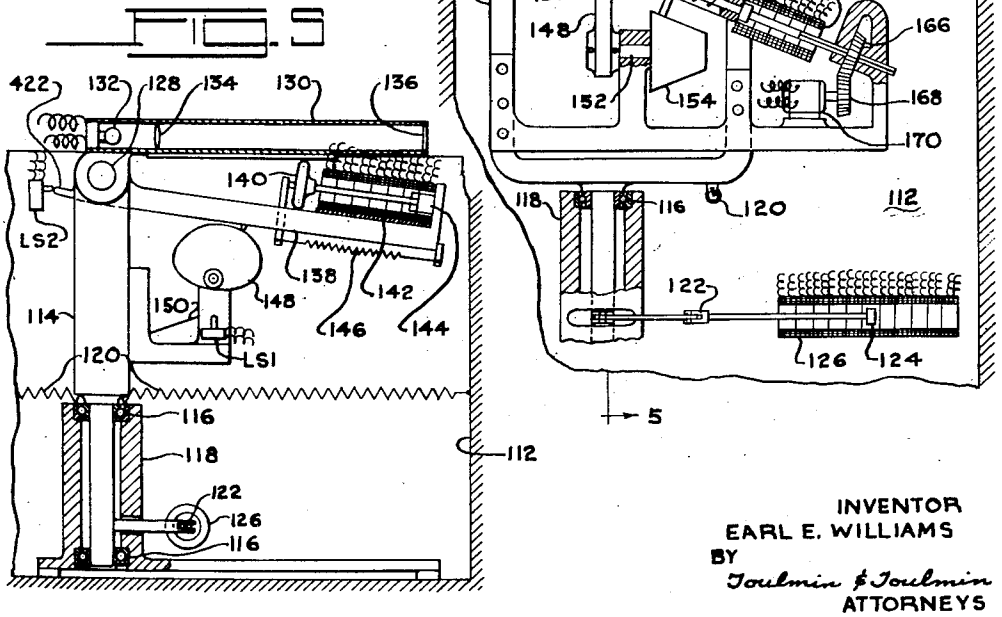


FIG. 4

FIG. 6

FIG. 5



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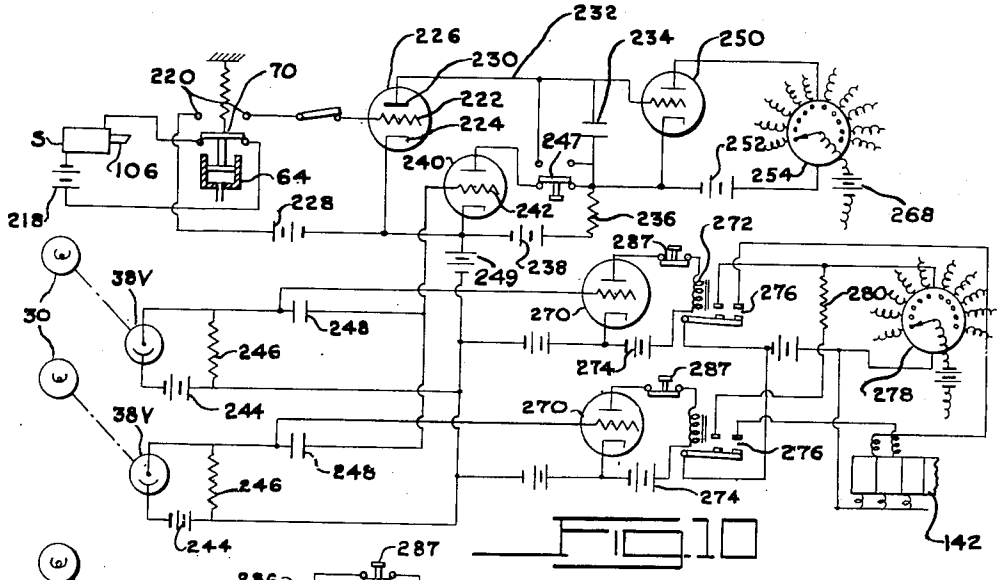


FIG. 10

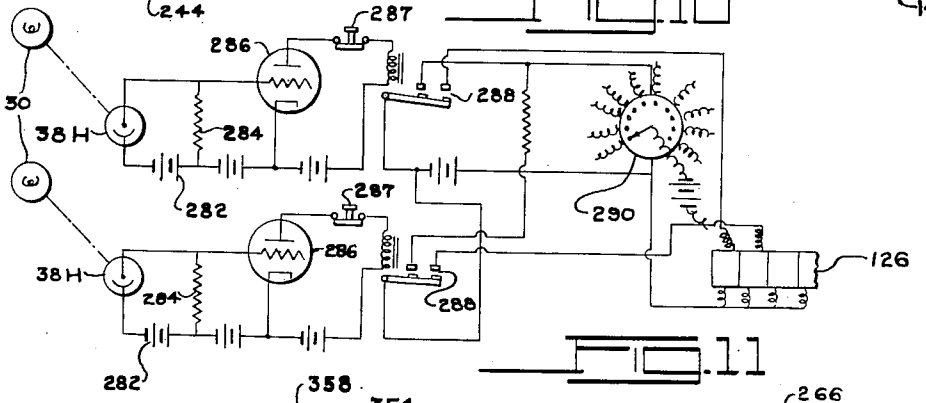


FIG. 11

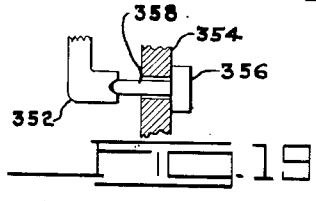


FIG. 19

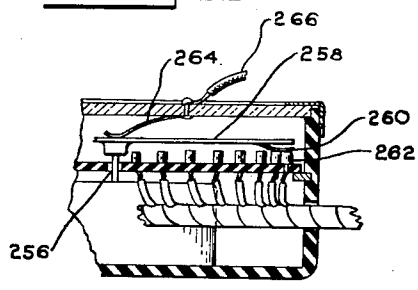


FIG. 12

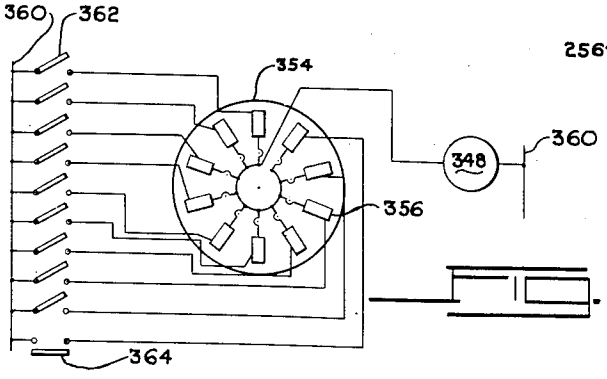


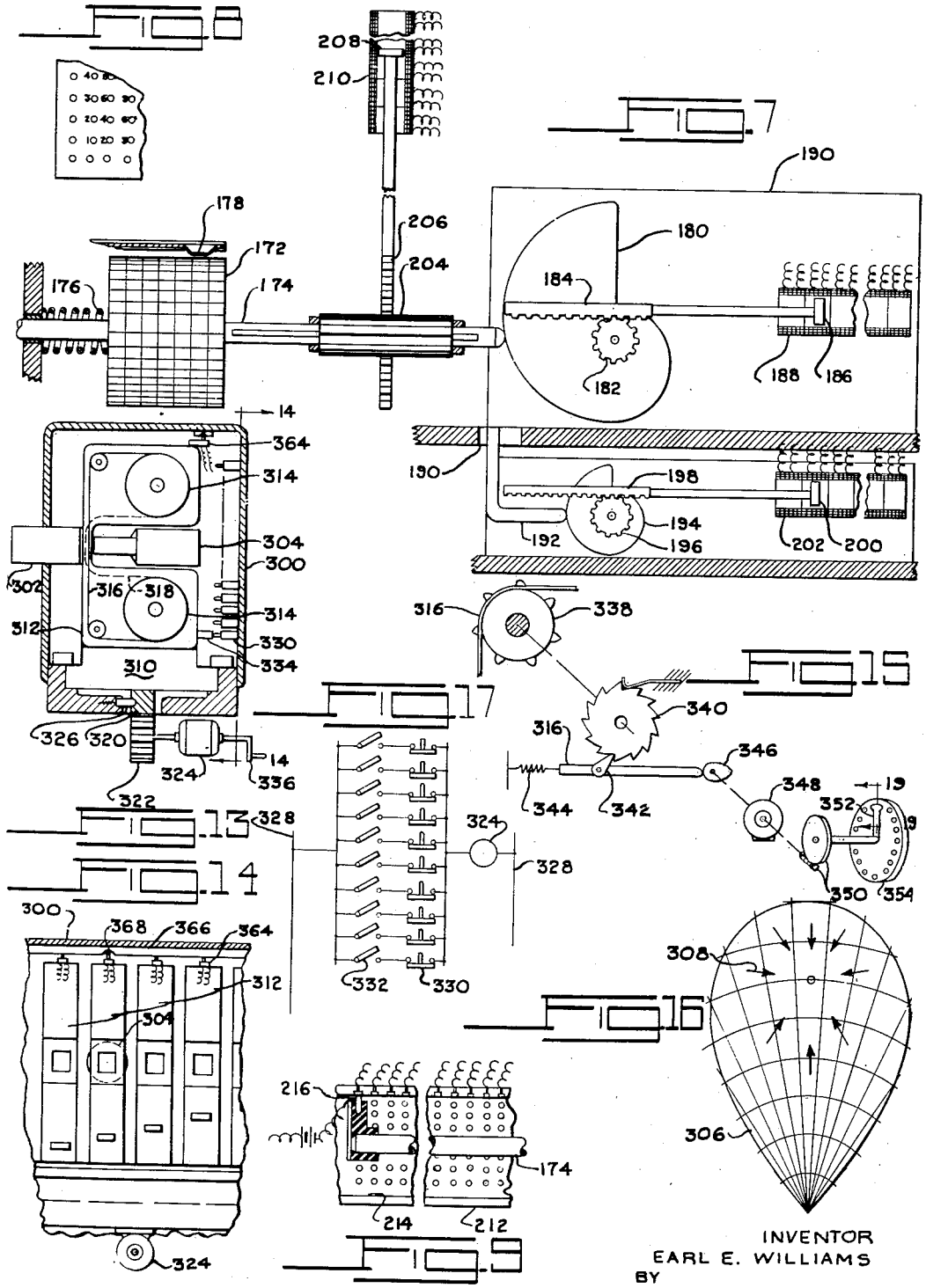
FIG. 18

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UNITED STATES PATENT OFFICE

2,581,738

GOLF GAME

Earl E. Williams, El Dorado, Kans.

Application February 18, 1948, Serial No. 9,169

10 Claims. (Cl. 273—87)

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This invention relates to a game, and particularly to an indoor golf game.

The particular object of this invention is to provide an indoor golf game which will be highly realistic and in which it is possible substantially to duplicate conditions encountered on the ordinary golf links.

A still further object is to provide an indoor golf game and including as a part thereof a calculator which automatically calculates the length of travel of the driven ball.

A still further object of this invention is to provide, in combination with an indoor golf game or driving range, a calculator which at one time calculates and indicates the length of travel of the driven ball and the approximate position at which the driven ball would normally come to rest.

It is also an object of this invention to provide, in combination with an indoor golf game or driving range, a projector which projects an image on a screen, which image moves to simulate the path which the ball would take if it had free flight.

It is also an object of this invention to provide an automatic tee for use in connection with golf games or driving ranges.

A still further object of this invention is to provide a device for projecting scenes which will be indicative of the position which the ball would have on an actual golf links whereby the player can determine the nature of the next shot.

These and other objects and advantages will become more apparent upon reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a general view showing somewhat diagrammatically an arrangement of an indoor golf game or driving range according to this invention;

Figure 2 is a somewhat enlarged view taken at the driving position of the range and showing the banks of photocells and actuating lights therefor arranged to detect the flight of the ball;

Figure 3 is a sectional view indicated by the line 3—3 on Figure 2 and showing the arrangement of lights and photocells in their supporting members;

Figure 3A is a sectional view indicated by the line 3A—3A on Figure 3;

Figure 4 is a sectional view of the automatic tee according to this invention which spots the ball preparatory to the driving thereof;

Figure 5 is a sectional view indicated by the line 5—5 on Figure 6 and showing the construction of the device for projecting the image of the

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driven ball on a screen whereby the driver can follow the flight of the ball;

Figure 6 is a view looking at the device shown in Figure 5 from the right side thereof and shows further details in connection therewith;

Figure 7 is a diagrammatic view of a calculating device for calculating and indicating the length of the flight of the ball which is driven;

Figure 8 is a fragmentary view showing a portion of the chart associated with the calculating device for indicating the length of the flight of the ball;

Figure 9 is a view showing one type of switch means to be associated with the calculating device and which is operable to relay certain information from the calculating device to the projector shown in Figures 5 and 6;

Figure 10 is a view showing one form of control circuit adapted for being actuated by the flight detecting photocells of Figures 2 and 3;

Figure 11 is a diagrammatic view of another circuit for use in conjunction with the circuit of Figure 10;

Figure 12 is a sectional view showing a portion of an instrument adapted to be associated with the circuits of Figures 10 and 11;

Figure 13 is a vertical section through another projection device which is operable to project images of scenes taken from different portions of the golf course and looking toward the hole thereof;

Figure 14 is a view indicated by the line 14—14 on Figure 13 and shows further details in connection with the construction of the projection device of Figure 13;

Figure 15 is a diagrammatic view showing the drive arrangement associated with each of the stations of the projection device of Figures 13 and 14;

Figure 16 is a diagrammatic plan showing a portion of a golf course between one tee and the next hole thereof and the manner of dividing the same into zones and how the scenes to be projected in the projection machine of Figures 13 and 14 are taken relative to the golf course;

Figure 17 is a diagrammatic view showing the control circuit for the drive motor in Figures 13 and 14;

Figure 18 is a diagrammatic view showing the control circuit associated with the drive motor of Figure 15;

Figure 19 is a sectional view indicated by the line 19—19 on Figure 15 and showing a control switch; and

Figure 20 is a diagram of the control circuit for the ball flight projector drive motor.

Referring to the drawings, the arrangement of this invention is generally illustrated in Figures 1 and 2.

In these figures it will be noted that there is a relatively large enclosure generally indicated at 10 and having at the left side thereof a tee-off position indicated by the arrow 12. A ball teed up at station 12 is driven off toward the wall 14 and which wall is so constructed that it will absorb the inertia of the ball and cause it to fall downwardly therefrom into the gutter 16.

Balls which are driven at a sharp angle upwardly will pass through the deflectors 18 and be deflected downwardly by the top wall portion 20. Such balls will be picked up by the transverse gutter parts 22 of the deflectors 18 and delivered into the gutter 24 at the edge thereof whence they roll down the said gutter 24 and fall into the gutter 16 behind the wall.

Adjacent the tee-off position 12 are a pair of light-photocell arrangements as indicated in Figures 2 and 3.

Referring first to Figure 2, the device indicated at 26 may comprise a frame supporting therein a series of light bulbs or lamps, while the member at 28 is a similar frame supporting therein a plurality of photocells which are respectively aligned with the lamps in the frame 26.

The arrangement of the lamps and photocells is indicated in Figures 3 and 3A, wherein it will be seen that each lamp 30 is arranged so that the light passes therefrom through a tube 32 and lens 34 by which it is projected in a substantially straight line across the distance between the frames 26 and 28 into a tube 36 behind which there is placed a photocell 38.

As will be seen in Figure 3A there is a continuous series of the lamps 30 in the frame 26 and a continuous series of the photocells 38 in the frame 28.

The partition members or tubes 32 and 36 serve to prevent illumination from any of the lamps falling on any but the photocell associated therewith and also prevent stray light from any source impinging on the photocells and affecting the operation thereof.

It will be noted that the frames 26 and 28 are arranged arcuately so that each lamp-photocell combination thereof is equidistant from an axis passing transversely through the ball supported on the tee. Similarly, there are positioned above and below the tee the light and photocell frames 40 and 42 which are similarly arcuately arranged about a line passing vertically through the center of the ball on the tee. The lights and photocells mounted in the frames 40 and 42 are identical with those in the frames 26 and 28, and hence no further description or specific illustration thereof will be given.

The ball, indicated at 44, is supported on an automatic spotting device which is illustrated in Figure 4. In Figure 4 the floor is indicated at 46 and the tee proper is indicated at 48 and comprises a rubber-like nipple extending above the level of the floor. The nipple 48 is supported on the hollow L-piece 50 which is rigidly supported in a block 52 that is pivotally mounted relative to the floor by a hollow shaft 54. The hollow shaft 54 communicates with the hollow interior of the L-shaped member 50 and therethrough with the nipple 48 by the passage 56. Connected with the hollow interior of the shaft 54 as by the tube 58 is a source of vacuum, and the tube 58 may include a throttle valve 62 if desired. The passage 56 also communicates with a cylinder 64

having therein a piston 66 which is continuously urged toward the right by a spring 68.

It will be apparent that when the ball 44 is resting against the open end of the nipple 48 that the vacuum established in the passage 56 will also be established within the cylinder 64 and act on the piston 66 to draw it leftwardly against the spring 68.

Positioned at the extreme right end of the cylinder 64 is a switch 70 which, when the vacuum is broken in the cylinder 64, is actuated by the piston 66 when it is moved rightwardly by the spring 68. The purpose of the switch 70 will be explained more in detail subsequently.

Directly beneath the nipple 48 and in alignment therewith is a tube 72 which has opening into the side thereof the arcuate tube 74 that leads to a ball hopper 76 supported on and conveniently located above the floor 46.

Slidably mounted within the tube 72 is a ball carrying member 78 which has secured thereto a rack 80 on which runs the pinion 82 carried on the shaft of a reversible motor 84. It will be apparent that driving the motor 84 in one direction will move the ball carrying member 78 upwardly, and driving the motor in the other direction will move the said carrier downwardly.

Associated with the portion of the tube 74 adjacent its connection with the tube 72 is an escapement for balls in the tube 74 consisting of a disc 86 and a pair of ball retaining pins 88 thereon which are movable in the arcuate slots 90 in the tube 74. The disc 86 carries an arm 92 and this arm extends into the path of a pin 94 carried on the ball carrying member 78 and projecting through a slot 96 in the tube 72.

It will be apparent that if the ball carrying member 78 is in an upper position that the disc 86 will be moved counter-clockwise by the spring 98 so that a ball will roll against the right hand pin 88. Thus, when the ball carrying member 78 is retracted downwardly to the position shown in Figure 4, the pin 94 will engage the arm 92 to rotate the disc 86 clockwise and thereby to release the ball resting against the right hand pin 88.

This arrangement provides for the delivery of one ball at a time to the ball carrying member 78. When a ball has been delivered to the ball carrying member 78 and it is desired to place the ball on the tee, the said ball carrying member is actuated upwardly. As it moves upwardly the ball strikes the L-shaped member 50 and lifts it to the dot-dash position indicated at 100 in Figure 4. At this time the said L-shaped member is free to fall beneath the ball due to the slot 102 in the side of the ball carrying member, so that when the ball carrying member is retracted the ball will be deposited on the upper end of the nipple 48 as is shown in Figure 4.

For the purpose which will become more apparent hereinafter, the ball carrying member 78 has a latch member 104 thereon adapted for being engaged by a stationary latch member 106 in which is connected a retracting solenoid S.

In operation, the motor 84 is normally energized from a battery 108 through a switch 110 to run in a direction to urge the member 78 downwardly. In order to drive the member 78 upwardly the motor 84 is reversed by pressing the switch 110. This reverses the direction of the motor and raises the member 78 to its uppermost position. Thus, when the switch 110 is released the motor 84 is reversed and moves the member 78 downwardly until the latch members

104 and 106 meet, at which time further movement of the member 78 is stopped. Thereafter, when the latch 106 is withdrawn by energization of the solenoid S the member 78 continues its downward movement and comes to rest due to action of an overrunning clutch of any suitable construction in the position shown in Figure 4.

Associated with the device of this invention is a flight projector which throws an image of a ball on the wall 14 and which image is caused to move downwardly at a proper rate of speed so the driver of the ball can follow what would have been the true flight thereof. This projector is shown in Figures 5 and 6.

Adjacent the tee station 12 is a pit 112 in the floor and within which there is rotatably mounted a post or frame 114 as by means of the bearings 116 carried in the base part 118.

This frame 114 is normally urged into a predetermined position by means of a centering spring arrangement indicated at 120 and has connected therewith, by means of the link 122, an armature 124 movable in the elongated and multiple solenoid 126.

The solenoid 126 is comprised of a plurality of individual coil parts and the armature 124 is operable to move lengthwise of the solenoid to the approximate center position of whichever one of the individual coil parts thereof is energized. This provides for a rotation of the frame 114 to the proper angle of flight of the ball as determined by the photocell banks, as will be explained hereinafter.

At the upper end of the frame 114 is a transverse pivot 128 on which is supported the projector tube proper 130 comprising the light source 132, lens 134, and an image producing member 136.

Also pivotally mounted about the pivot 128 is a platform 138 and between the platform and the bottom of the tube 130 is a cam 140. The cam 140 is movable longitudinally of the platform 138 by means of a multiple solenoid arrangement 142 which is substantially identical to the multiple solenoid 126 and within which there is an armature 144 connected with the cam 140. A biasing spring 146 provides for the return of the cam 140 upon de-energization of the solenoid 142.

The solenoid 142, as will become apparent hereinafter, is energized in accordance with the vertical angle at which the ball is driven from the tee and operates through the cam 140 to tilt the tube 130 to project an image of the ball on the wall 14 at the apex of flight of the ball. Thereafter the tube 130 moves downwardly so that the ball falls to the ground.

The means for moving the tube 130 downwardly comprises a cam 148 rotatably mounted on the bracket part 150 supported on the frame 114. This cam is carried on a shaft 152 which also carries the conical drive member 154. The conical drive member 154 is engaged by a driving disc 156 which is urged in one direction by a spring 158 and which is adapted to be moved in the opposite direction by an armature 160 slidable in the multiple solenoid 162.

The multiple solenoid is energized in accordance with predetermined calculations automatically made by devices connected with the photocell banks, as will be explained hereinafter, and shifts the driving disc into such position that the rate of movement of the tube 130 will be approximately correct for the rate of speed at which the driven ball is traveling.

The shaft 164 which supports the driving disc 156 and armature 160 is splined or feather-keyed by the bevel gear 166 which is driven by a second bevel gear 168 mounted on the shaft of a synchronous drive motor 170.

It will be understood that in operation the tube 130 rotates in a horizontal plane to point in the proper direction, tilts upwardly to pick up the flight of the ball at the apex thereof, and then moves slowly downwardly thereby to simulate the actual flight of a driven ball. These several movements will be explained somewhat more fully in connection with the calculating and control circuits associated with the photocell banks.

The game of this invention also includes a calculating and indicating device by means of which the length of the flight of the ball is automatically indicated. This arrangement is diagrammatically shown in Figures 7 and 8.

In these figures it will be noted there is a drum 172 which is mounted on a shaft 174 for rotary and axial movements. A spring 176 continuously urges the drum rightwardly to an extreme right hand position so that the viewing window 178 is positioned over the left hand side of the drum. The right hand end of the shaft 174 bears against a rotary cam 180 which mounts a pinion 182 that is engaged by a rack 184. The rack 184 is connected with an armature 186 axially movable within the multiple solenoid 188. It will be apparent that the armature 186 will take a position within the solenoid 188 corresponding to the individual coil thereof which is energized and thus actuate the rack 184, pinion 182, cam 180, and shaft 174 to position the drum 172 axially relative to the viewing window 178.

As will be explained subsequently, the energization of the solenoid 188 is controlled in conformity with the velocity of the ball, which velocity is measured by a circuit controlled by one of the photocell banks adjacent the tee-off position. Inasmuch as the photocell banks are arranged to be equi-distant from vertical and horizontal axes passing through the center of the ball on the tee at right angles, any deviation of the flight of the ball from a true rectilinear path will result in an error in the velocity measured. Accordingly, the cam 180 and its drive mechanism is mounted on a slide 190 and this slide has an arm 192 which is abutted by a correction cam 194 which mounts a pinion 196 engaged by the rack 198. The rack 198 is connected with the armature 200 of the multiple layer solenoid 202. The solenoid 202 is energized in conformity with the measurement made by the photocell banks of the deviation of the flight of the ball from a true rectilinear path and introduces a correction into the amount of movement given the drum 172 and thus effects an approximate correction of this error.

The total flight which a ball will have when driven from a tee is a function not only of the velocity thereof but of the angle of flight which the ball makes. Accordingly, the measurement which is made of the vertical angle of flight of the ball is introduced into the calculator by means of the pinion 204 which is splined or feather-keyed to the shaft 174 and which engages the rack 206 connected with the armature 208 of the multiple solenoid 210. It will be apparent that the armature 208 will take the position in the solenoid 210 in accordance with the energization thereof and, through the rack 206, pinion 204, and shaft 174, rotates the drum 172 to change its position relative to the viewing window 178.

The chart on the drum 172 may be graduated

in any predetermined manner and one type of graduation is illustrated in Figure 8. In this figure it will be noted that the indications on the drum progressively increase from left to right and likewise increase from the bottom to the top. The reading which appears beneath the window 178 is thus determined by the amount of movement to the left of the drum 172 and the amount of rotation thereof beneath the window. In combination with cams of a predetermined shape together with multiple solenoids of a specific design, any predetermined arrangement of a chart on the drum can be had. Preferably, the chart on the drum is linear and the cams and multiple solenoids are so shaped that proper axial and rotative movements of the drum will be had so that the linear graduations thereon will be correct.

Carried on the end of the shaft 174, as shown in Figure 9, is a multiple bank switch 212 comprising a plurality of angularly arranged and axially spaced contact banks 214 and a switch arm having a contact member 216 adapted for engaging the said contact banks. The individual contacts in the several banks are connected with the multiple solenoid 162 of the ball flight projector of Figures 5 and 6.

Since this solenoid of the ball flight projector is that which determines the rate at which the tube 130 moves downwardly, it will be apparent that it must be interrelated with the length of flight of the ball. The longer the flight of the ball the greater length of time for it to drop from the apex of flight thereof to the ground and the shorter the said flight the shorter the said time.

The multiple contact switch at 212 thus provides a ready means for determining the action of the tube 130 so that a realistic simulation of the flight of the ball will be had.

The photocell banks shown in Figures 1, 2 and 3 are connected in circuit as shown in Figures 10 and 11. It will be understood that there are a plurality of photocells in both the vertically and horizontally arranged banks thereof, but since the circuit for each of said cells is substantially like that for each of the others in the respective banks thereof, only two of the vertical cells and two of the horizontal cells have been illustrated.

The vertically arranged cells are shown in circuit in Figure 10 and are identified therein by the reference numerals 38V. The circuit in which they are connected is an arrangement for measuring the velocity of the ball, for providing the impulse to operate the solenoid 210 of the calculating device, the impulse for operating the solenoid 142 of the ball flight projector, and to provide the impulse for operating the solenoid 138 of the calculator.

The circuit is explained more in detail as follows:

The solenoid S associated with the retractible latch member 106 is connected in circuit with the switch 70 through a battery 218. As will be seen, when there is a vacuum in the cylinder 64 the switch 70 is drawn into position to energize the solenoid S and thus to retract the latch member 106. The switch 70 is so arranged that when the vatcuum is released from the cylinder 64 it will close on a pair of contacts 220 which are in circuit between the control grid 222 and the cathode 224 of the gas discharge tube 226. Also in the circuit is a biasing battery 228 and when the circuit is completed between the cathode and the grid the battery is of such a size as to cause the tube to ionize and to commence a discharge therethrough to the plate 230.

The plate 230 is connected by a wire 232 with one side of a condenser 234, the other side of which is connected through a resistor 236 and the plate battery 238 with the cathode. The size of the resistor 236 and condenser 234 is so adjusted relative to the battery 238 that the condenser will gradually charge up over a period of time.

It will be evident from the description immediately preceding that when a ball is spotted on the tee the switch 70 will move into its Figure 10 position and retract the latch 106 so that the ball carrying member 76 will move downwardly away from the tee. Thereafter, when the ball is driven from the tee the vacuum in the cylinder 64 will be broken and the switch 70 will close on the contact 220 substantially instantaneously. This will instantaneously commence the discharge of the tube 226 and commence the charging up of the condenser 234.

The arrangement illustrated thus provides a means for determining the exact instant the ball is driven from the tee. In order to provide for a measurement of the length of time the ball moves in flight between the tee and the photocell banks, there is a second gas discharge tube 240 having its plate connected with the condenser end of the resistor 236 and its cathode connected with the cathode 224 of tube 226.

Upon discharge of the tube 240, by properly biasing its grid 242 a current will flow through the resistor 236 which will so reduce the plate potential of the tube 226 that it will become deionized and discharge therefrom will cease. This will halt the charging of the condenser and the charge thereon can then be measured to determine the length of time which has elapsed between the triggering of the tubes 226 and 240.

The triggering of the tube 240 is accomplished by the vertically arranged photocells 38V. Each of these cells is connected in circuit with a battery 244 and a resistor 246. The positive end of the resistor 246 is connected with the cathode of the tube 240 and the negative ends thereof are connected through the condensers 248 with the grid 242.

Normally current flows through the resistor 246 and thus applies a negative bias to the grid 242 to maintain its potential at cut-off. However, when the driven ball intercepts any of the beams falling on the tubes 38V, there is a momentary reduction in the current flow through the associated resistor 246. This is reflected as a voltage rise at the grid 242 which triggers the tube 240 to discharge. This arrangement thus provides for a means to halt the charging of the condenser 234. A grid bias battery, 249, may be provided if desired, or necessary, due to the characteristics of the tube 240. The measuring circuit can be cleared at any time by pressing the switch 247 which shunts out the charge on the condenser and breaks the plate circuit of the tube 240.

The aforementioned condensers 248 are for the purpose of isolating each of the tubes 38V from the others thereof in order that the said tubes may be utilized for measuring the vertical angle of flight of the ball.

Returning to the condenser 234, the charge thereon is preferably measured by an electrostatic means, such as the amplifier tube 250, which has its plate and cathode connected in circuit with a battery 252 and an instrument 254. By this arrangement the charge on the condenser 234 can be measured without substantially reducing the

said charge. This provides for a highly accurate measurement of the said charge.

The instrument 254 may comprise any suitable type of instrument movement and is preferably arranged as shown in Figure 12, wherein it will be seen that the meter shaft 256 carries an arm 258 having a sweep contact 260 thereon adapted for successively brushing over the stationary contacts 262. A connection may be made with the contact arm 258 as by the spring pressed rider 264 and wire 266.

It will be evident that the instrument movement and the arrangement of the contacts 262 could be so selected that the charge on the condenser 234 could be transferred into any suitable units, that is, should it be required to indicate the square of the charge on the condenser, or a trigonometric function of any angle determined by the said charge, this could be accomplished by a suitable arangement of the contacts and the instrument movement. No particular arrangement of these contacts and no particular type of movement has been illustrated because it is believed that it will be evident that this selection is largely a matter of choice and is well within the skill of the usual instrument maker.

The several contacts 262 are connected in circuit with the solenoid 188 of the calculator and the battery 268. It will be apparent that the instrument 254, solenoid 188, and cam 180 can be so arranged and interrelated that axial shifting of the drum 172 will give a true measurement of the velocity of the ball as reflected in the charge on the condenser 234, the velocity being in inverse ratio to the charge on the condenser.

Each of the photocells 38V has associated therewith a discharge tube 270 which has the control grid thereof connected with the negative end of the resistor 246 of the photocell. The plates of each of the tubes 270 are connected through a relay coil 272 and a battery 274 with the cathode of the said tube.

In response to the interruption of the beam falling on any of the photocells 38V the corresponding tube 270 thereof will be ionized by the positive impulse to the grid thereof and the said tube will commence to discharge and will close the associated relay 276. Each of the relays 276 has associated therewith a pair of contacts, one of which is connected in circuit with an instrument 278 similar to the instrument 254 of the tube 250, and the other of which is connected in circuit with the multiple solenoid 142 of the ball flight projector.

To provide for different degrees of deflection of the movable member of the instrument 278, the several tubes 270 have their respective relay contacts connected with the said instrument by resistors of different sizes as indicated at 280. It will be apparent that by properly selecting the resistors 280 the instrument 278 can be deflected to a predetermined degree by the closing of each of the relays 276 when their corresponding tubes are fired.

It will be evident that there are many more of the cells 38V than are shown in Figure 10 but that the circuit connections for each of these tubes will be identical with that shown. Accordingly, the two cells illustrated in the drawings form a complete disclosure of a typical circuit.

Figure 11 shows the manner of connecting the horizontal photocells 38H in circuit. Each of these cells has a battery 282 and a biasing resistor 284. When the tubes are illuminated the current through the resistor 284 insures a negative bias on the grid of the tube 286. However, when the beam to any of the cells 38H is interrupted a positive impulse is delivered to the grid of the associated discharge 286 ionizing the same and causing it to discharge through the coil of the associated relay 288. Each of these relays, similarly to the relays 276 in Figure 10, have a first contact connected with an instrument 290 through a resistor of predetermined size, and a second contact connected in circuit with the multiple solenoid 126 of the ball flight projector.

It will be apparent that the arrangement shown in Figure 11, by including as many photocells 38H as are needed, provides a means for tilting the projector tube 30 in a horizontal plane so that it passes in the direction of ball travel and at the same time provides for deflection of the instrument 290 to a predetermined degree. The instrument 290 is connected in circuit with the correction solenoid 202 of the calculator. The correction applied to the indicated flight of the ball on the calculator is thus determined by the deviation of the flight of the ball from a true forward path as measured by the horizontal cells 38H.

Any of the circuits controlled by any of the cells 38H or 38V can be cleared at any time by opening the plate circuits of the controlled tubes 270 or 286 by the switches 287, and it will be apparent that all of the switches 287 and the switch 247 could be mounted together as a unitary gang switch whereby the entire electrical system could be cleared by pressing one button.

In order to provide a realistic situation when driving the ball from the tee, it is preferable that a series of drives be made therefrom as though the driver were going from a tee to the next hole on a regular golf links. An arrangement for accomplishing this is shown in Figures 13 through 19.

In Figure 13 there is shown a frame 300 having a projection lens system 302 and a light source 304. The projector is preferably located so that it projects a scene on the wall 14. These scenes are so arranged that they represent about what the player would see if he were standing at a predetermined place between the tee and the hole toward which he was driving. These scenes may be selected as shown at Figure 16 by dividing the golf links between the tee and the holes by a plurality of zones as indicated at 306 and take a picture from the center of each zone looking toward the hole as indicated by the arrow 308. These scenes may be arranged in the form of slides or, according to the preferred arrangement of this invention, on a continuous film and a film arranged for each hole so that it can selectively be moved into alignment with the light source 304 and lens system 302.

Returning to Figure 13 it will be noted that within the frame 300 there is a slide 310 and mounted on the said slide is a bracket 312 supporting a pair of reels or rolls 314 over which passes the film 316. This film, as explained before, comprises a series of scenes taken from the centers of the various zones between one tee and one hole on the golf course and looking toward the said hole.

According to this invention the film is continuous and is looped back as at 318 so that by continuously driving the said film in one direction all of the frames thereon can be projected on the screen and the film returned to its original starting position.

As will be seen in Figure 14 there are a plurality of brackets 312 and in practice there would be one thereof for each hole of the course. For moving the slide 310 longitudinally of the frame 300 in order to bring the proper one of the brackets 312 into alignment with the projection equipment, the said slide carries a rack 320 engaged by a pinion 322 on the shaft of a motor 324. There is preferably a spring detent as at 326 which provides for accurate location of the slide 310 in each of its operative positions.

The means for driving the motor 324 is shown in Figure 17. In this figure the motor 324 is connected between the electric lines 328 through a plurality of parallelly arranged branches, each of which comprises a limit switch 330 and a selector switch 332. The limit switches 330 are shown in Figure 13 as mounted at different levels on the back of the frame 300. In alignment with each of the switches 330 is a cam 334 carried on the back of the corresponding frame 312.

It will be apparent that closing of any of the switches 332 will energize the motor 324 to drive the slide 310 until the corresponding cam 324 on the said slide engages and opens the switch 330 which is in series with the closed switch 332. Inasmuch as the slide 310 will probably be indexed one step each time and then returned its whole length to the starting position, the said motor shaft may be provided with a crank as at 336 for returning the slide to its starting position after a complete round has been played. After the slide 310 has been moved to bring the proper one of the brackets 312 into alignment with the projection system, the film 316 is moved to bring the proper scene into alignment with the light source 304 and lens system 302. This may be accomplished by the switch and drive arrangement shown in Figures 15, 18 and 19.

Figure 15 shows a sprocket drive member 338 which drives the film 316 and which is carried on a shaft with a ratchet wheel 340. A pawl member 342 is spring urged in one direction by a spring 344 and is moved in the opposite direction by a rotary cam 346, so that indexing movements of the sprockets 338 can be had by rotation of the said cam. The cam 346 is carried on the shaft of a motor 348 that also drives through the reduction gearing 350 and to a shaft carrying a rotatable arm 352. The rotatable arm 352 moves over a disc or plate member 354 which carries a plurality of switches 356 having actuating members as at 358 positioned to be engaged by the end of the arm 352.

The circuit arrangement for the motor 348 and the switches 356 is illustrated in Figure 18. In this figure it will be noted that the motor 348 is connected between the electric power lines 360 and in series with a plurality of parallelly arranged branches, each of which contains one of the switches 356 in series with a normally open manually operable switch 362. Upon the closing of any of the switches 362 the motor 348 will be energized and will run continuously, and index the ratchet wheel 340 and sprocket 338 until the arm 352 engages and opens the one of the switches 356 in series with the closed switch.

By providing for the proper amount of reduction gearing, the sprocket 338 can be indexed the proper amount to bring the frames of the film into proper alignment with the light source and lens system.

Inasmuch as it is desirable that the films always occupy the same position when they are moved into the projection station, one of the

switches 356 is connected with a normally open limit switch 364 which is mounted on the top of the corresponding bracket 312.

As will best be seen in Figure 14 there is a cam 366 carried on the top of the frame 300 and which is operable to close each of the switches 364 when the slide 310 is moved to carry the corresponding bracket 312 out of the projection station. The one of the brackets 312 which is in the projection station has its switch 364 in an open position due to the recess 368 in the cam 366. Thus, after a hole has been played and the projection equipment is shifted to bring a new film into alignment with the lens system and light source, the film previously in operative position automatically runs back to its starting position.

The means for controlling the ball flight projector motor 170 is illustrated in Figure 20. In this figure it will be seen that when the switch plate 70 closes on the contacts 220 a circuit is completed from the battery 218 through a relay coil 400. This coil operates on an armature 402 to move a blade 404 into position to complete a circuit between the electric lines 406 and 408 through a relay coil 410 which, in turn, exerts an upward pull on the armature 412 carrying a contact blade 414.

The armature 412 is connected with a dash-pot arrangement 416 which delays the closing thereof. The purpose of this is to delay the actuation of the ball flight projector motor until approximately the time that the ball would normally reach the apex of its flight.

The blade 414 is adapted for closing on a pair of contacts to complete a circuit between the lines 406 and 408 and through the ball flight projector lamp 132 and the aforementioned ball flight projector motor 170.

It will be evident that the blade 404 will remain closed until a ball is again spotted on the tee 100 and sufficient vacuum is drawn in the cylinder 64 to cause the switch blade 70 to move away from the contacts 220. However, the motor 170 only runs for a sufficient length of time to cause the cam 148 to bring the tube 130 downwardly to a level position with the floor or therebeneath by means of a limit switch LS1 shown in Figure 5 and so positioned that the high part of the cam 148 will engage and open the said switch when the high part of the said cam is down. The switch is indicated in Figure 20 as in series with the relay coil 410. Thus, when the cam has reached this position and the tube 130 has been lowered the motor 170 and lamp 132 become deenergized. Thereafter, it is desirable to return the cam 148 to its starting position and this is accomplished by means of an auxiliary relay having an operating coil 418 and a blade 420 which, when the said coil is energized, will complete a circuit through the motor 170 regardless of the condition of energization of the coil 410. This will cause the motor to run until the coil 418 is deenergized by the opening of a limit switch LS2 in series therewith and which is indicated in Figure 5 as in position to be engaged by a cam projection 422 on the arm 138. The relay coil 418 is arranged to be energized by a blade 424 which is preferably associated with the gang switch arrangement referred to hereinbefore and by means of which the entire electrical circuit is cleared preparatory to making new drive from the tee station. Inasmuch as there will be a new ball spotted on the tee at that time the relay coil 400 will be de-energized and the relay coil 410 will also remain de-energized regardless of the posi-

tion of the limit switch LS1. The arrangement shown in Figure 20 thus provides a means for conditioning the ball flight projector so that it is ready to pick up the flight of the ball when it is driven from the tee.

Summary of operations

The operation of the game according to my invention may be summarized as follows:

Assuming a ball to be spotted on the tee as shown in Figure 4 and the electrical circuits all cleared by the operation of the clearing switch, the ball is then driven from the tee.

As soon as the ball leaves the tee the vacuum is broken in the cylinder 64 and the switch blade 70 is actuated to trigger the tube 226. This initiates the timing cycle, and thereafter when the ball interrupts the beam falling on any of the vertically arranged photocells, the second tube 240 is triggered thereby to terminate the timing cycle.

The charge built up on the condenser 234 during the timing period is electrostatically conveyed to the instrument 254 causing the pointer thereof to deflect to a predetermined position thereby to determine a certain energization of the multiple solenoid 188 which operates the cam 180 to effect an axial positioning of the drum 172. At the same time the timing period is terminated by interruption of one of the beams of a vertical photocell, the said vertical cell also triggers the tube 270 associated therewith to pull in the associated relay 272, whereupon the instrument 278 assumes a deflection, depending upon the one of the cells 38V to which the beam was interrupted. The deflection of the instrument 278 determines the energization of the multiple solenoid 210 thereby actuating the drum 172 in a predetermined rotary movement through the rack 206 and pinion 204.

Simultaneously, the one of the tubes 270 which is fired determines the energization of the multiple solenoid 142 which actuates the cam 140 and tilts the tube 132 upwardly so that its axis simulates the flight of the ball at the apex thereof.

Simultaneously, with the actuation of one of the vertical photocells one of the horizontal cells 38H has the beam thereto interrupted which causes the firing of the associated tube 286, whereupon the associated relay 288 is pulled in to determine a deflection of the instrument 290 as well as the energization of the multiple solenoid 126.

The multiple solenoid 126 operates through the armature 124 and linkage 122 to rotate the tube 130 so that its axis lies in a common vertical plane with the trajectory of the driven ball.

The deflection of the instrument 290 determines the energization of the multiple solenoid 202 which operates through the rack and pinion 198, 196 and cam 194 to introduce a correction into the axial movement of the drum 172 to correct for deflection of the line of flight of the ball from a dead-ahead path.

At this time the calculator is in a full actuated position and the approximate yardage which the ball has been driven can be read through the window 176. When the calculator has assumed its final position the drum switch 212 determines a certain energization of the multiple solenoid 162 which determines the driving ratio to obtain between the motor 170 and the cam 148.

A predetermined time after the tube 226 is fired the motor 170 will become actuated and simultaneously the lamp 132 is illuminated. This casts an image of the ball on a screen in approximately the true position thereof. As the motor 170 continues to run the image of the ball will drop downwardly until it disappears by the tube reaching the level of the floor or falling therebeneath.

At this time the driver can record in any suitable manner the yardage which he has driven and the angle from the tee and thus determine on exactly what part of the course his ball is supposed to be lying.

At that time he may prepare for the next drive by selecting, through the bank of switches 332, the projector for the hole toward which he is driving. Having selected the correct film he can then select one frame thereof through the bank of switches 362, and an image will be thrown on the screen or on the wall 14 such that when he stands at the tee 12 he will be looking at approximately the same scene he would be as if he were on the course at the point where his ball had been driven.

A new ball is then spotted on the tee by pressing the switch 110 which causes the ball carrier 78 to move upwardly to its uppermost position. The switch 110 is then released and the carrier 78 moves downwardly, sets the ball on the tee, and is halted by the latch 106. Thereafter, the closing of the end of the tee by the ball causes a vacuum to build up in the cylinder 64 which brings about the retraction of the latch 106 and the movement of the carrier member 78 to its lowermost position where it receives a new ball.

The driver then clears the electrical circuit by operating the gang switch mentioned before, or by operating the switches 247 and 287 and 424 individually. Preferably these switches are ganged together, but it will be understood that they could be operated individually if desired.

The entire system is now in its initial condition and the image which is projected on the wall or screen at 14 is such that the driver can determine the exact nature of his next shot in order best to approach the green. It will be evident that most of the individual devices disclosed in this application can be duplicated in function by other devices and that the scope of this invention should in no wise be restricted to the exact instrumentalities shown and described herein. Essentially what this invention consists of, and of which the accompanying drawings and this specification form only an exemplary disclosure, is a means for automatically spotting a ball, for determining the velocity and orientation thereof when driven from the tee, for automatically calculating the length of drive of the ball, for projecting an image on the screen whereby the driver can follow the flight of the ball, and for permitting the driver to select the scene for projection on the screen or wall ahead of the tee station so that he is driving off therefrom under conditions which simulate those which would be encountered on a regular golf course.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In an indoor golf game; a tee for the support of a golf ball; a switch actuated in response to driving a ball from said tee; a wall spaced from said tee having means to absorb the inertia of a ball driven thereagainst; flight detector means

between said tee and said wall; including a time measuring arrangement calculator means having its operation initiated from said tee and interrupted by said detector means for calculating and detecting the theoretical free travel of the driven ball in accordance with the detection of its line of flight and velocity as determined by said detector means; and means including light projection means controlled by said detector means and operable to project an image simulating a ball in flight on said wall.

2. In an indoor golf game; a tee for the support of a golf ball; a switch actuated in response to driving a ball from the said tee; a wall spaced from said tee having means to absorb the inertia of a ball driven thereagainst; flight detector means between the said tee and said wall; calculator means including a time measuring arrangement having its operation initiated from said tee and interrupted by said detector means for calculating and detecting the theoretical free travel of the driven ball in accordance with the detection of the time interval of ball flight from said tee and the line of flight of the driven ball as determined by said detector means; means including light projection means controlled by said detector means and operable to project an image simulating a ball in flight on said wall; and driving means operable together with said light producing means to produce said projected image at positions corresponding to those which the driven ball would have in free flight including image movement downwardly to simulate the actual flight of the driven ball.

3. In an indoor golf game; an enclosure having a tee for the support of a golf ball at one end; a switch actuated in response to driving a ball from said tee; a vertical and a horizontal bank of photocells and spaced banks of lights for illuminating said cells arranged in front of said tee so that a ball driven therefrom will normally interrupt light beams to at least one cell in each bank; a timing circuit operable upon actuation of said switch to measure the time between the driving off of said ball and the interruption of one of said beams; other means including circuit means associated with said photocells responsive to the interruption of said beams to detect the vertical and horizontal deviation of the flight path of the ball from dead ahead; and a calculator and indicator coupled with said timing circuit and said other means for integrating the data pertinent to the trajectory of the driven ball and for indicating the theoretical free flight of a ball so driven.

4. In an indoor golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; photocell-light banks embracing an area in front of said tee to detect the passage in flight of said ball; circuit arrangements coupled with said photocell-light banks for detection of the time interval for ball flight from said tee and line of flight of the driven ball; means for pictorially indicating the theoretical flight of the driven ball comprising a projector for throwing a moving image simulating a ball on the said wall, said image being controllable by said detector means; and a calculator having its operation initiated upon driving said ball from said tee and interrupted by said passage of said ball through said banks and operable to indicate the total free flight of the driven ball.

5. In combination with a golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; detector means, including photocell-light banks positioned between said tee and wall, for detecting the time interval for ball flight from said tee and direction of flight of the driven ball; calculator means coupled with said detector means and having the operation thereof initiated upon driving said ball from said tee and interrupted by said passage of said ball to indicate the total free flight of a ball so driven; means including light projection means controlled by said detector means and operable to project an image simulating a ball in flight on said wall; and means for projecting a scene on said wall which will be a substantial duplicate of a scene visible from a corresponding point on a golf course, said image simulating said ball traversing said scene to come to rest at a point in said scene.

6. In combination with a golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; detector means including photocell-light banks positioned between said tee and wall, for detecting the time interval for ball flight from said tee and direction of flight of the driven ball; calculator means coupled with said detector means and having the operation thereof initiated from said tee and interrupted by said detector means to indicate the total free flight of a ball so driven; means including light projection means controlled by said detector means and operable to project an image simulating a ball in flight on said wall; and means for projecting a scene on said wall which will be a substantial duplicate of a scene visible from a corresponding point on a golf course, said last mentioned means comprising a plurality of individual scenes and means to select the desired scene and to project it to said wall, said image simulating said ball traversing said scene to come to rest at a point in said scene.

7. In combination with a golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; detector means including photocell-light banks positioned between said tee and wall, for detecting the time interval for ball flight from said tee and direction of flight of the driven ball; calculator means coupled with said detector means and having the operation thereof initiated from said tee and interrupted by said detector means to indicate the total free flight of a ball so driven; means including light projection means controlled by said detector means and operable to project an image simulating a ball in flight on said wall; and means for projecting a scene on said well which will be a substantial duplicate of a scene visible from a corresponding point on a golf course, said last mentioned means comprising a plurality of individual film strips, a projection station, means to move said strips into said station, and means for driving said strips through said station to project selected scenes therefrom, said image simulating said ball traversing said scene to come to rest at a point in said scene.

8. In combination with a golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; detector means including photocell-light banks positioned between said tee and

wall, for detecting the time interval for ball flight from said tee and direction of flight of the driven ball; calculator means coupled with said detector means and having the operation thereof initiated from said tee and interrupted by said detector means to indicate the total free flight of a ball so driven; means including light projection means controlled by said detector means and operable to project an image simulating a ball in flight on said wall; and means for projecting a scene on said wall which will be a substantial duplicate of a scene visible from a corresponding point on a golf course, said last mentioned means comprising a plurality of individual film strips, a projection station, means to move said strips into said station, means for driving said strips through said station to project selected scenes therefrom, and means including a cam operated arrangement responsive to movement of said film strips out of said projection station for retracting said strips to their starting position said image simulating said ball traversing said scene to come to rest at a point in said scene.

9. In combination with a golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; detector means including photocell-light banks positioned between said tee and wall, for detecting the time interval for ball flight from said tee and direction of flight of the driven ball; projector means to throw an image simulating a ball on the wall and controlled by said detector; said projector comprising a projector means, means to move said projector means vertically and horizontally so the image on the said wall will represent the true flight of the ball at the apex thereof; and cam means operable automatically in connection with a motor drive to cause said projector means to move downwardly to simulate the dropping of the ball during the last half of its trajectory.

10. In combination with a golf game, a tee for the support of a golf ball, a switch actuated in response to driving a ball from said tee, a wall spaced from said tee adapted to stop the flight of a driven ball; detector means including photocell-light banks positioned between said tee and wall, for detecting the time interval for ball flight from said tee and direction of flight of the driven ball; projector means to throw an image simulating a ball on the wall and controlled by said detector, said projector comprising a projector means, means to move said projector means vertically and horizontally so the image on the said wall will represent the true flight of the ball at the apex thereof; and cam means operable automatically in connection with a motor drive to cause said projector means to move downwardly to simulate the dropping of the ball during the last half of its trajectory, said cam means being variable in speed according to the determined trajectory of said ball.

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