

Nov. 7, 1950

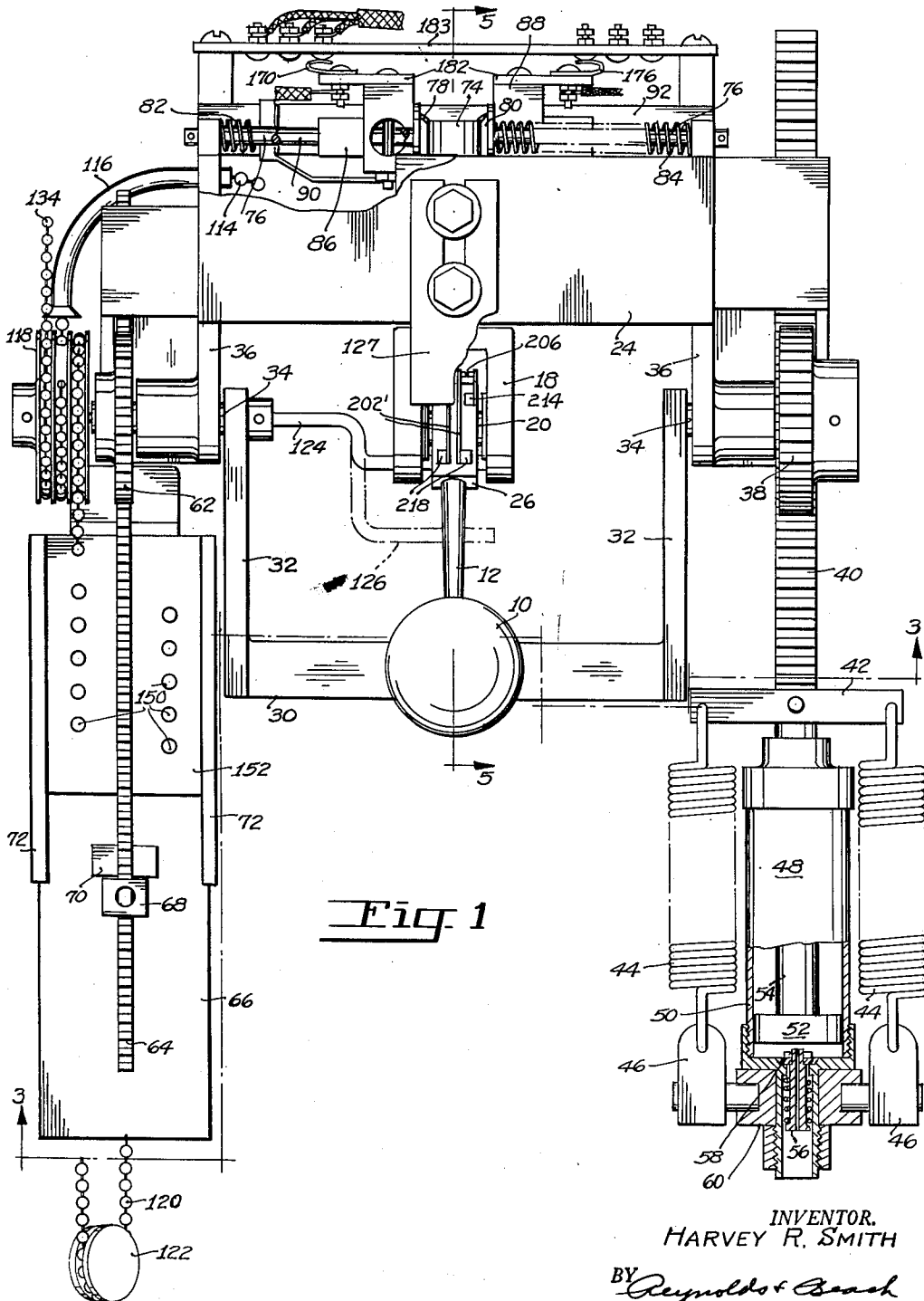
H. R. SMITH

2,528,616

GOLF DRIVING MACHINE

Filed Feb. 16, 1948

4 Sheets-Sheet 1



Nov. 7, 1950

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4 Sheets-Sheet 2

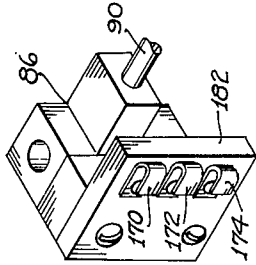


Fig. 8

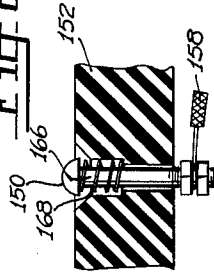


Fig. 9

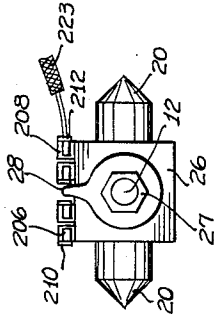


Fig. 7

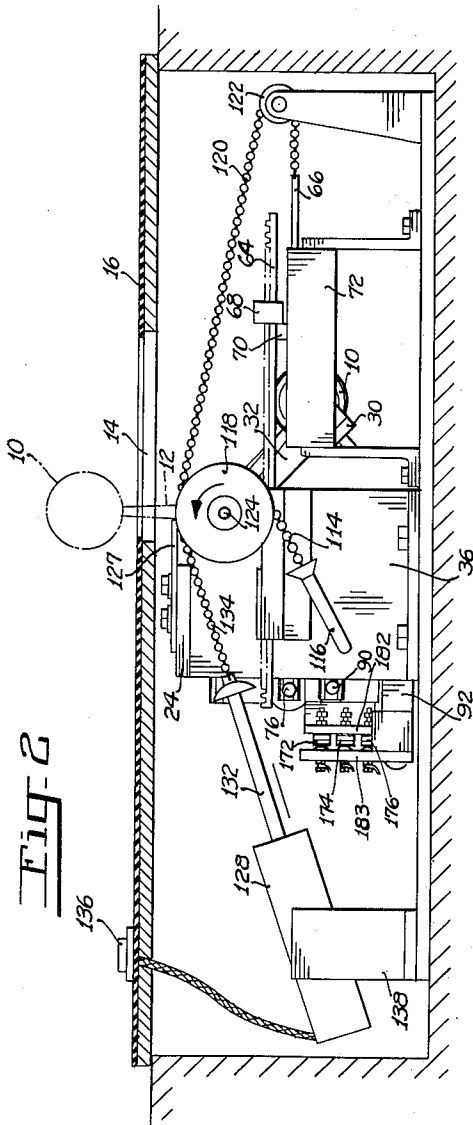


Fig. 2

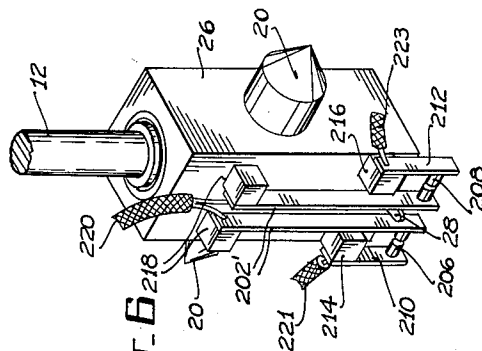


Fig. 6

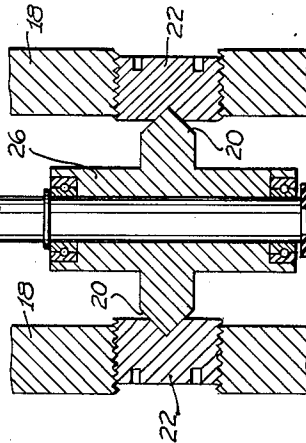


Fig. 4

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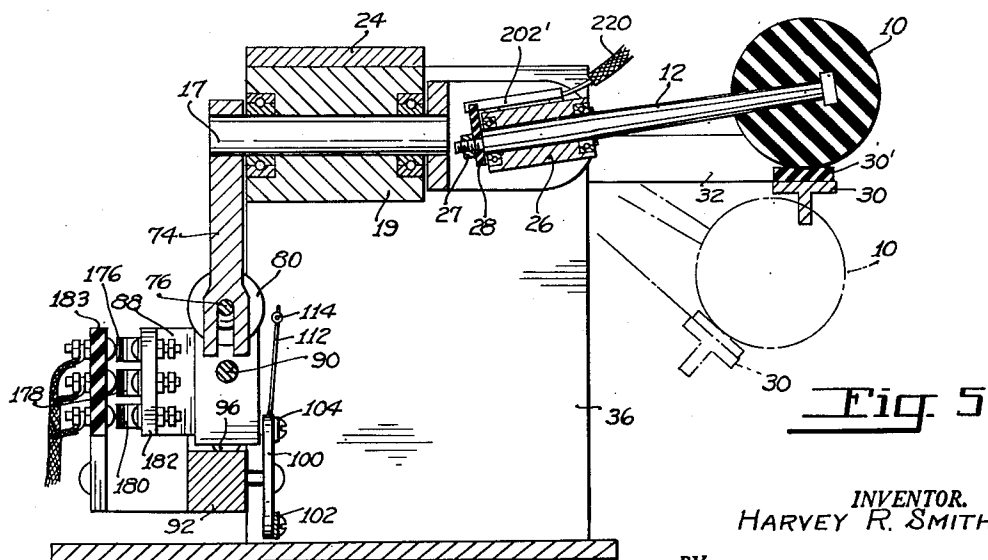
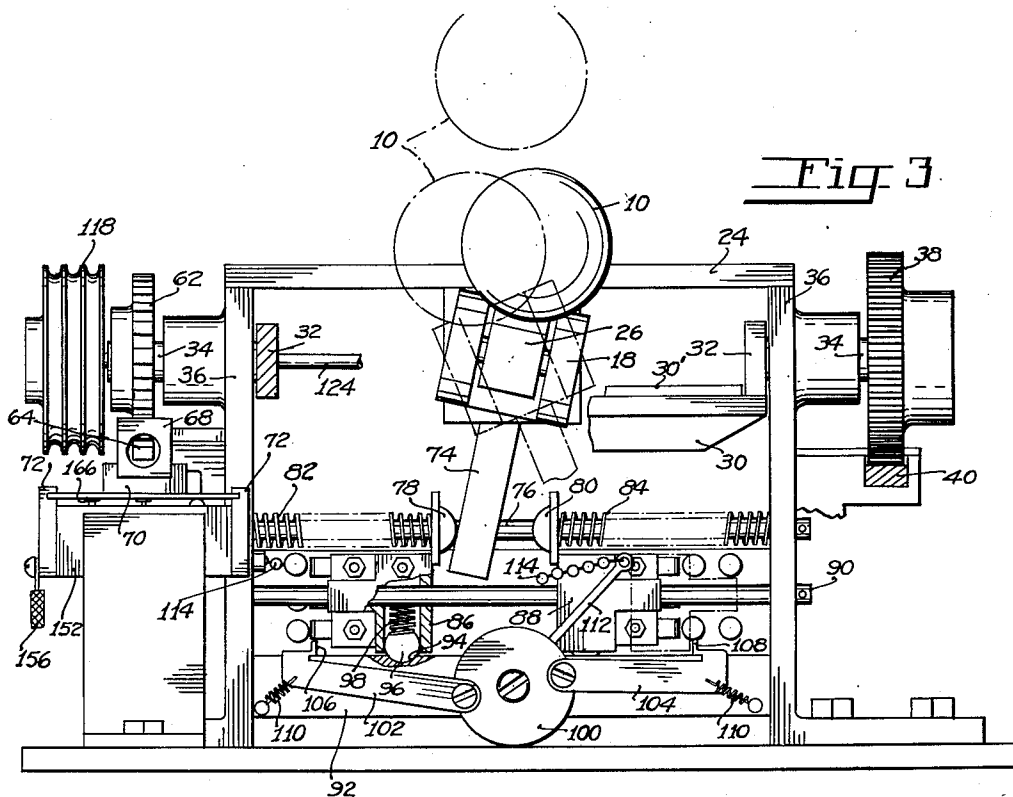
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4 Sheets-Sheet 3



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Fig 11

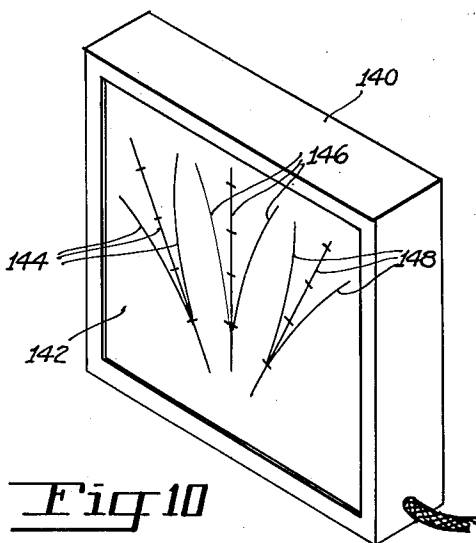
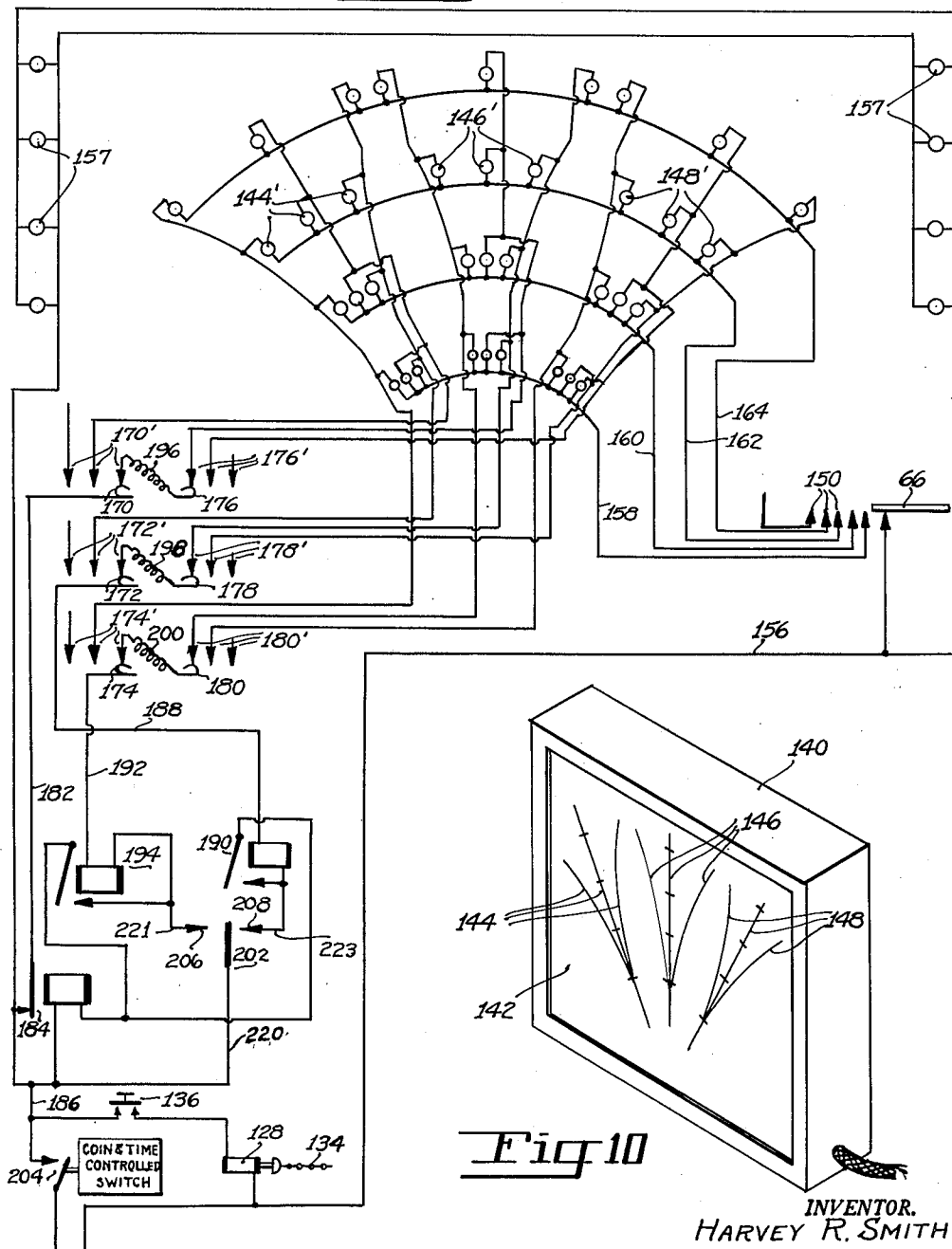


Fig 10

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UNITED STATES PATENT OFFICE

2,528,616

GOLF DRIVING MACHINE

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Application February 16, 1948, Serial No. 8,641

5 Claims. (Cl. 273—35)

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This invention relates to golf ball practice driving apparatus enabling the golfer to perfect his driving form rapidly and without resort to a practice driving range or the like. It is an object to provide a compact, rugged and reliably accurate practice device including means accurately simulating a teed golf ball presented in the normal manner to the practicing player, and indicator means responsive to the impact of the club on the simulated ball, and affected by its force, direction and mode of application, to provide indication of the resultant effect which would be imparted to a ball by the player's driving stroke.

In its illustrated form, while a struck artificial golf ball mounted in my device is not free to be projected in flight, the flight or trajectory characteristics of an actual golf ball struck in the same manner may be estimated and indicated accurately by the reaction of such artificial ball in its special mountings. The indications made available by the apparatus include the estimated driving distance, to which the force of driving impact of the golf club is readily converted, the estimated approximate amount and sense of deviation or initial divergence of the ball, whether to the right or left, from the direction of nominal aim, and whether a hook or slice curve would have been effected by the club's impact tending to spin the ball appreciably.

It is another object of the invention to provide actuating mechanism the operation of which can be coordinated readily to operate single indicator means making possible the convenient display of these variable factors to the player in prominent fashion immediately following a driving stroke, and to make the mechanism responsive to slight differences in driving strokes and capable of recycling rapidly by being reset conveniently by the player.

It is an important object of the invention to accomplish the foregoing with an artificial ball so mounted as to resemble and feel to the player, when struck by his club, like a normally played ball. The driving form of the player thus developed by such practice may be applied directly to actual play on a golf course without requiring a change of playing habit.

Accordingly, a feature of the invention resides in the combination of a lightweight, freely movable support pivoted for swinging forwardly and carrying integral with it a simulated golf ball at its swinging upper end arranged to actuate an estimated-distance indicator which is energized by the impact of the struck ball element. The

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indicator or marker, operated each time the ball element is struck, remains in indicating condition until the device is recycled for another play.

In addition, the support mountings permit it to swing laterally or sidewise to actuate selectively second indicator means showing the estimated deviation to the right or left of the path of aim that a ball would be driven by the stroke.

Preferably appropriate illumination of an indicator board is effected by switching means actuated by the simulated ball element to display in prominent pictorial manner the estimated drive distance and deviation for each stroke. An indication of slice or hook detected by tendency of the ball support to be rotated about an upright axis as the ball element is struck may actuate further switching means, for additional control over energization of the indicator board illuminating means.

Still another feature comprises resetting mechanism for returning the simulated ball element support to dispose the ball element in its upraised, teed position, and restoring the indicator and display means to their initial condition in readiness for a succeeding play. The resetting operation may be effected simply by the player energizing a recycling solenoid or similar device at the proper time.

Various other features, including the details of construction and operation of my apparatus will now be described with greater particularity by reference to the accompanying drawings illustrating its preferred form.

Figure 1 is a plan view of my golf ball practice driving mechanism; Figure 2 is a side elevation view of the same installed for operation; and Figure 3 is a front elevation view with parts broken away along line 3—3 of Figure 1, showing the detail of the flight-deviation indicating mechanism and the action of a struck ball element in operating such mechanism.

Figure 4 is a detail sectional view of the pivotal mounting for the ball-support spindle; and Figure 5 is a longitudinal sectional view of the device taken on line 5—5 of Figure 1, showing means for indicating estimated deviation of a driven ball, and in broken lines illustrating the action of the struck ball element displacing the actuating member for the distance indicator.

Figures 6 and 7 are top perspective and lower end views, respectively, of the ball element support spindle mounting and associated switching means responsive to turning of the spindle when the ball element is struck in such way as would normally produce a slice or hook.

Figure 8 is a top perspective view of an element of electrical switching means associated with the estimated ball deviation indicator.

Figure 9 is a detail sectional view showing a switch contact of the type employed in both the distance and deviation indicating mechanism.

Figure 10 is a simplified perspective view of an illuminated display board to use with the machine, and Figure 11 is a schematic diagram of the electric light control circuits for the board.

The simulated golf ball element 10 preferably comprises a rubber or plastic sphere of the same shape, size and inertia as a normal golf ball. The ball element support, shown best in Figures 1 and 5, comprises a spindle 12 simulating a golf ball tee, supported for universal pivoting at its base and projecting upwardly from it through an aperture 14 in the floor 16 or driving mat on which the player stands and beneath which the machine is installed. Figure 2 shows in broken lines the ball element and spindle in upraised, teed position, ready for driving.

The aggregate weight of the ball element 10, spindle 12, and parts carried directly by it, is selected of such value as to resist movement of the golf club to a degree similar to the resistance offered by an actual golf ball teed and driven in normal manner. When struck, the ball element, swinging forward on its support, disappears instantly through the aperture 14 and thereby offers no interference to follow-through of the player's club. The ball does not reappear above the driving mat until motivated by the player resetting the apparatus when he is ready.

The predominant driving force and resulting swinging movement of the ball element and supporting spindle occurs in a forward direction, and to a less extent sidewise. The principal pivot of the spindle thus arranged horizontally, transversely of the plane of golf club swing, enables forward tilting of the spindle in such plane. Such pivot may comprise conical-tip bearings 20 engaging conical recesses in plugs 22, which are threaded in holes in the legs of yoke 18, to support the spindle between such legs. By turning the plugs in their holes 22 the engagement of the conical supporting tips may be adjusted for tightness and to center the spindle in yoke 18. To enable the spindle to swing sidewise if the ball element 10 should not be struck exactly in the plane of its intended travel, yoke 18 itself is mounted for rotation about a horizontal axis extending longitudinally of the apparatus, in the line of normal drive of the ball, having a supporting shaft 17 journaled in a suitable mounting block 19 carried beneath the frame plate 24.

In addition to the foregoing two types of freedom of the ball element, enabling it to swing forwardly and to either side when struck from its teed position, the spindle is journaled for turning about its own axis in a supporting sleeve 26 formed integrally with the conical bearing tips 20. At the upper end of the sleeve 26 the spindle 12 has an annular rib which abuts the adjacent side of an antifriction bearing received in the end of the sleeve to prevent the spindle slipping downwardly. At the lower end the spindle is held in the sleeve by a nut 27 threaded onto the end of the spindle and bearing against washer 28, which in turn contacts an antifriction bearing received in the sleeve. By removal of nut 27 spindle 12 and ball element 10 may be replaced easily. If the ball element should be struck a glancing blow rather than squarely, a torque will be applied to spindle 12 which will turn it in its

bearings, the amount of torque being related to the degree of inaccuracy of the blow.

The first consideration in deriving a measure of the driving power of a stroke applied to the ball element 10, in order to estimate the distance in flight a comparable free ball would have been driven, is to determine the momentum imparted to the ball member 10 when struck by the golf club. This is preferably accomplished by absorbing the kinetic energy of the ball assembly, as it swings forwardly on its support, by a spring, and utilizing the resulting maximum displacement of the spring as an indication of such momentum. Accordingly, after limited movement of the ball member in an arc forwardly and downwardly about bearings 20, it strikes yieldable impact-receiving means comprising a displaceable anvil 30 which is supported at the ends of pivotal arms 32 in a position for receiving the impact of the struck ball element after it has cleared the golf club and dropped through the driving mat opening. During such travel the spindle 12 swings through a fairly large angle, preferably approaching a right angle. At their opposite ends the arms 32 are supported by the aligned shafts 34, journaled for swinging about a horizontal axis in the opposite sides 36 of the machine frame. A rubber pad 39 covers anvil 30 to increase the life of the ball and reduce the shock of each impact with the anvil.

One of the shafts 34 extends through its side 36, to the projecting end of which is secured a pinion 38. Meshing with such pinion is rack 40, as seen in Figures 1 and 3, the forward end of which is connected to a cross bar 42. This bar is held against movement rearwardly by a pair of stiff, tension springs 44 reacting between opposite ends of the cross bar and corresponding anchoring supports 46, to which cross bar ends and supports the opposite spring ends are fastened. As the ball element strikes anvil 30, depressing it, gear 38 is turned to displace rack 40 rearwardly against the combined tension of springs 44. The distance through which the anvil is driven downward is limited by the tension of the springs which absorb the kinetic energy of the ball member 10 and moving parts associated with it. The maximum spring displacement is thus related directly to the driving power applied to the ball element by the swung golf club.

While various devices may be employed to prevent the ball 10 from being heaved violently upwardly by the force of the springs 44 acting through the gear and rack connection on the anvil following their extension, in the mechanism shown, the springs react against a dashpot 48 designed to allow them to be stretched freely by movement of the rack effected by the impact of the ball, but to contract only slowly. This damping action of the dashpot minimizes shock and excessive wear in the apparatus, and thus increases the life of its moving parts. The dashpot may comprise a fixed outer cylinder 50 and coating piston 52 connected by rod 54 directly to the rack 40. Cylinder 50 is carried by a stationary supporting bracket 60 which also carries the anchoring supports 46 for the springs 44. The cylinder has an opening 58 normally closed by a spring loaded plunger 56. While the spring opposes movement of the plunger in a direction to open orifice 58 during the outward stroke of the piston, it is a light spring needed merely to insure movement of the plunger to close port 58 when the piston's motion is reversed, so that

the piston can move outward substantially freely. When the plunger closes, only a small central orifice extending through the plunger remains through which air trapped in the cylinder can escape while the piston is drawn toward the orifice by springs 44 as they contract.

While the anvil 30, the rack 40, the spring assembly and the dashpot are necessarily constructed ruggedly for receiving and withstanding the heavy impact loads imposed on them by the ball element 10, the indicator mechanism by which the ball's momentum is measured may be of comparatively lightweight construction. Such mechanism includes a relatively fine-pitch pinion 62 secured on the shaft 34 opposite that which carries pinion 38. Rack 64, meshing with pinion 62, as shown in Figures 1 and 3, is driven rearwardly by such pinion when the anvil is swung downward, carrying with it a lightweight follower comprising plate 66 sliding in guide ways 72. The rack and follower are interengaged for such conjoint movement in only one direction of the rack's movement by block 68 secured adjustably to the rack 64, abutting an upwardly projecting catch 70 mounted on plate 66, as shown in Figures 1 and 3.

The plate, thus moved by the rack 64, travels a distance corresponding to the stretch of springs 44 effected by the displacement of rack 40. Despite the prompt return of rack 64 to its forward position, conjointly with a corresponding return forwardly of rack 40 and upward movement of anvil 30 effected by contraction of springs 44, slide 66 remains in its farthest displaced position to indicate the momentum of the struck ball element. Thus plate 66 serves as an estimated drive distance indicator, remaining in its displaced indicating position until the apparatus is reset. Not only does the plate afford a direct visual indication of estimated driving distance by its position, but it may constitute a switch element for controlling the actuation of remote, drive distance indicating display means, in a manner to be described.

In order to establish by design the extent of the displacement of the anvil following impact, and hence that of the follower plate 66, the springs 44 may be selected to have any desired characteristics, or they may be supported in adjustable or preloadable mountings to enable their initial tension to be established when installed. Variations such as this may be effected in any of various known ways.

If the ball element 10 is not struck along the direct line of aim, straight ahead, spindle 12 supporting it will be swung sidewise by the golf club's impact, as well as forwardly, resulting in yoke 18 turning about its supporting shaft 17. In order to measure and indicate the degree of sidewise swinging momentum of the ball to serve as a basis for estimating flight path deviation or divergence, shaft assembly 17 connected to the yoke carried a downwardly projecting finger 74 having a downwardly opening transverse slot formed in its lower end, in which is received a horizontal, upper guide rod 76 over which the finger slides as it swings, transversely of the device, as shown in Figures 3 and 5. In its neutral position the finger hangs downwardly in vertical position where it is held, closely flanked on either side by the opposing slides 78 and 80 encircling the upper guide rod 76. Each slide has a rounded, finger-contacting button urged toward the finger by a compression spring. These springs 82 and 84 encircle shaft 76. The springs react between

the slides 78 and 80 and corresponding sides 36 of the machine frame.

Slides 78 and 80 have flanges arranged to abut the upper edges of corresponding followers 86 and 88, respectively, which are guided for sliding movement along the lower guide rod 90 disposed parallel to rod 76. At the base of the machine a detent-receiving bar 92 (Figures 3 and 5) is mounted parallel to the rods directly beneath the followers 86 and 88, and is provided in its upper side with a plurality of spaced cavities 94 in which a registering detent ball 96 carried by each follower, may be lodged selectively by force of its detent spring 98. Such detents need not also hold buttons 78 or 80 against its spring 82 or 84 because the head 78 or 80 merely pushes against its follower. Each follower 86 and 88 may thereby assume one of several stopping positions, corresponding to the different displacements of one of springs 82, 84 occurring with different degrees of rotation of shaft 17 caused by various angular deviations of the ball element struck off the correct line of aim.

Thus when the ball element 10 is struck sidewise, swinging finger 74 laterally, the opposing slide 78 or 80 will be moved outwardly along rod 76 against the force of its spring 82 or 84, respectively, a distance corresponding to the amount of lateral deflection of the ball element. Such slide movement displaces to the same degree the corresponding follower 86 or 88 to one or another of the detent registering positions. Because of the detent, the follower remains in its displaced position while the spring and slide return to their initial positions, recentering the finger 74 and yoke 18. One of the followers 86 or 88 corresponds to a left deviation of the ball, while the other corresponds to a right deviation, and, as shown later herein, each of the followers 86 and 88 acts as a switching member carrying contacts which control the operation of the illuminating display board coordinately with the switching action of the follower plate 66 of the distance indicator.

To reset the apparatus for a subsequent play, it is necessary to return the displaced follower members 66, 86 and 88, to their initial positions and erect the ball support spindle 12. All these operations may be accomplished simultaneously by suitable mechanism. The follower 86 or 88 displaced may be returned to its initial position by rotation of a crank disk 100 (Figure 3), effected by turning a crank arm 112 connected to the disk. Links 102 and 104 connected to the crank disk at opposite locations for conjoint opposite reciprocation with rotation of the disk, carry at their outer ends the slide catches 106 and 108, respectively. The catches are guided to slide lengthwise over the detent socket bar 92 to engage either of the followers and carry it inwardly. Each of links 102 and 104 has a return spring 110, which returns its link to its initial position, such movement simultaneously returning crank disk 100 to its neutral position. Crank arm 112 is turned by drawn chain 114 connected to it, and the latter extends from the crank arm through a guide tube 116, curved in a right angle arc, to guide the chain for wrapping around drum 118, to which the end of the chain is fastened.

Follower plate 66 moving in guides 72 is returned to its initial position by draw chain 120 (Figures 1 and 2) guided through a 180 degree turn from such plate around a fixed sheave 122, thence doubling back for wrapping around drum 118, to which its end is likewise secured. Such

drum is suitably grooved to receive both the chains, and is keyed or otherwise fixed to a supporting shaft 124 received and journaled concentrically within the shaft 34 supporting pinion 62. It will therefore be evident that rotating drum 118 wraps on it chains 120 and 114, the former connected to plate 66 and the latter to the return mechanism for followers 86 and 88, thus simultaneously returning all of the followers to their initial positions.

In addition the same rotation of this drum is operative to raise the ball element 10 to its teed position. Shaft 124 has at its inner end an offset 126 constituting a contact arm which engages beneath the ball element supporting spindle 12. By upward swinging of this offset the ball element is raised into teed position when shaft 124 is rotated to return the displaced followers to their initial positions. A stop, such as a leather or rubber tab 127, seen in Figures 1 and 2, limits the upward swinging movement of the spindle by engagement therewith when in its substantially vertical position.

Rotation of drum 118 and shaft 124, to effect all of the return movements discussed, is accomplished by actuation of a master control comprising solenoid 128 having a reciprocable plunger 132 connected to a draw chain 134 wrapped around and secured to the drum 118. The solenoid is supported by brackets 138 in such manner that the path of the plunger and the stretch of draw chain connected to it are in alignment. As the solenoid is energized, plunger 132 is drawn into it, which pulls on chain 134. The player may energize the solenoid manually to reset the device by depressing a floor switch 136 in the solenoid-energizing circuit, or solenoid energization may be effected automatically by a suitable timing device of any well known type, set to energize the solenoid after a selected interval of time following each downward swinging movement of the ball element supporting spindle 12.

In order to display clearly and graphically, or pictorially, to the practicing player the estimated effect of each practice drive, I provide an illuminated display board 140 (Figure 10) controlled by switches actuated by the several indicator means of the driving apparatus. Such a board is the subject of my copending application Serial No. 8,642, filed February 16, 1948. As a visual aid to the player, after each play the board displays an illuminated pattern or line simulating or representing approximately the path of a struck ball, in plan view, as when played normally on a golf course or driving range. For this purpose the front of the board has an opaque screen 142 which is made translucent along different selected lines representative of typical paths of a golf ball struck in the various possible ways, the lines being arranged in a plurality of groups, such as the groups 144, 146 and 148.

In the illustrative simplified board, the central group of these lines 146, comprising a middle vertical line originating near the bottom of the screen 142 and extending straight upwardly to a point near its top, and a pair of lateral curved lines originating approximately at the same point at the bottom of the screen and diverging outwardly as they extend upwardly on either side of the middle line. This central group of lines represents the flight path of a golf ball struck by a golf club moving accurately along the path of aim. The similar groups of lines, 144 and 148, represent the possible paths of a ball struck with deviation to the left or to the right, respectively,

from the path of aim. If, in any of these directions of drive the ball element is struck without slice or hook the middle line only of the appropriate group will be illuminated. The right and left curved lateral lines, diverging from each side of the middle line, represent the flight paths of a ball struck with appreciable slice or hook depending upon the direction in which the ball element spindle 12 tends to turn and the side of the ball element on which the player stands. Thus, whether the ball was struck with or without slice or hook is indicated in each instance in addition to its deviation or lack of deviation.

The translucent line on the screen which corresponds to the appropriate estimated path of a struck ball is illuminated by a system of lights located behind the screen. For each such line there is a corresponding line of lights, and lights of a line are positioned at spaced locations corresponding to selected driving distances, commencing with the light nearest the bottom of the screen. With each drive the number of lights illuminated behind the correct flight path line, hence the length of that line illuminated, depends upon the estimated length of drive corresponding to the power of the driving stroke. A more elaborate display board could be provided, if desired, as shown in my copending application mentioned above, for example.

In Figure 11 the arrangement of the lights behind the screen is shown connected in the indicator-actuated control circuits operating them. The lights arranged to correspond to the groups of lines 144, 146, 148 on the screen are designated with the same numerals primed. Each such group, 144', 146', and 148', is made up of a plurality, in this case four, of separate rows of lights which lie along the arcs of concentric circles of successively increasing diameters and centered near the base of the screen, from which center the divergent lines radiate generally. The arcuate rows of lights correspond to different driving distances to which the translucent lines are to be illuminated. Obviously more rows of such lights may be employed where the driving distance is to be indicated more exactly.

Usually no lights need be provided to designate less than a certain distance corresponding to the inmost circle of lights, because of the inconvenience in mounting the lights on the board close together and the infrequency, and ready recognition, of dubbed drives by the player.

If the estimated driving distance does not exceed that corresponding to the inmost row of lights, one light of that row, and none of the other lights on the board, will then be illuminated. If the estimated driving distance is greater, to the extent that it corresponds to the location of the next row of lights, both the light in that row and the one in the inmost row in the appropriate flight path line will be illuminated; similarly for other estimated driving distances and flight-path lines. If desired, the individual lights behind the screen may be shielded from each other so as to illuminate only the portions of the translucent lines to which they correspond, preventing diffusion of light tending to confuse the player as to the correct indicated direction or range of a played ball.

Anticipating use of the device in country or athletic clubs, driving ranges, or the like, a coin-operated and time-, or play-controlled

switch 204 of suitable type may be employed as a master control which must first be actuated by depositing a coin before the display board control circuit can be energized or solenoid 128 can be operated to reset the apparatus. By deposit of a coin the switch 204 is closed and will remain closed to permit the device being used for a limited time or for making a predetermined number of strokes, depending on the election of the owner. Lights 157 arranged about the display board in any desired manner are connected in circuit with switch 204 to light up the board generally whenever this switch is closed, indicating that the machine has been placed in operation. The board generally may be colored and decorated to represent a golf course driving area.

In the display board control circuit, connected in series with switch 204, separate switching systems are employed to account for the separate control factors of driving distance, flight path deviation, and slice or hook. The switching system for the factor of driving distance is actuated by or includes follower plate 66 of the driving apparatus (Figure 1), movable into contacting engagement with one or more of a series of spaced contacts 150. Such contacts may be supported stationarily in an insulating plate 152. The metal plate 56 is energized from its sliding contact with the metal guides 72, to which is connected an electrical lead 156 branching from one side of a source of current for illuminating the electric lights.

As the ball element of the apparatus is struck, and the anvil 30 depressed accordingly, the follower plate 66 is shifted to a distance-indicating position where it engages a number of contacts 150, including the one nearest to it, depending upon the driving power of the stroke. Accordingly, one or more of the wires 158, 160, 162, 164, extending to corresponding terminals of all the lights in their respective rows, as shown in Figure 11, are energized from the lead 156. Contacts 150 may be spaced apart by any selected distances along the direction of movement of follower plate 66, to produce the desired graduation scale of distances represented by the successive rows of lights, or to correct for non-linearity of the displacement of springs 44 as a function of correct estimated driving distance.

Figure 9 illustrates a suitable construction of contacts 150. Each comprises the round head of a pin 166 received in a vertical hole in the insulating plate 152. The upper portion of each hole is enlarged to form a shoulder between which and the base of the pin-head a helical spring 168 reacts to force the pin upwardly normally into a position projecting slightly above the surface of plate 152, where it may be contacted by the overlying follower plate 66 as it is reciprocated by rack 64. To the lower end of each pin is secured the bare end of an insulated wire, such as lead 158, clamped between a pair of nuts threaded on such pin.

The estimated flight path deviation switching system includes groups of movable contacts, one group being moved in response to deviation of the ball element 10 to the left of the path of aim, while the other group is moved in response to such deviation to the right of the path of aim. For example, the group for leftward deviation may include the three contacts 170, 172, and 174 whereas the other, independently movable group includes the separate, contacts 176, 178 and 180.

As will be shown, the three separate contacts of each group are connected in circuit branches energized in accordance with the presence or absence of slice or hook of the struck ball.

The triplet contact groups are mounted with their contacts in spaced vertical relation on insulating plates 182, one of which is secured to each of the transversely movable follower slides 86 or 88 (Figures 1 and 8). The individual contact groups are thereby displaced in accordance with the deviation to the left or right of the path of aim of a struck ball by turning of shaft 17 and swinging of lever 74 to shift the slides 86 and 88 as described previously.

Corresponding groups of stationary switch contacts 170', 172', etc., engageable by the moving contacts just described, are supported in a vertical insulating mounting 183. The position of each group corresponds to the locations of the sockets for the detents of the followers 86 and 88. In Figure 11, three such stationary groups are indicated, designated by the same numerals primed, as the movable contacts which are respectively engageable by the contacts of the movable group. The contacts of each stationary group are connected to the lights for one group of path lines on the board 140 corresponding to the respective degree of flight path deviation. The contacts of both inmost groups, corresponding to zero deviation, are connected in series to the lights of the central group of lines 146.

With the machine set in readiness for the ball to be struck, the contacts of the inmost groups of stationary contacts are engaged and continue to be engaged following a play if the amount of deviation imparted to the ball element 10 is insufficient to swing the finger 74 laterally enough to move the detent of one of slides 86 or 88 from its normal position to the next along the detent bar 92. As the ball element is struck more to the left or right, the movable contacts of a slide 86 or 88 may engage the contacts of the second, third or more remote group of stationary contacts on the corresponding side of the neutral position of finger 74. The stationary contacts are separately energized selectively from the terminal of the source of illuminating current opposite lead 156. Between the movable contacts and such terminal is interposed the hook-and-slice switching mechanism.

Contact 170, corresponding to the lights for illuminating the central line in each group, is connected to wire 182 which extends through the normally closed contacts of relay 184 to the principal energizing lead 186; wire 188 is connected to contact 172, corresponding to the lights for the right line in each display board group, to extend to one side of the field winding of a holding relay 190; and lead 192 is connected between contact 174, corresponding to the lights for the left line in each display board group, and one side of the field winding of a similar relay 194. Contacts 176, 178, and 180 of the other group of movable contacts are respectively connected by flexible leads 196, 198 and 200 to the inmost ones of the corresponding stationary contacts of the group 170', 172' and 174', as shown in Figure 11.

Energization from lead 186 of any of movable contacts 170, 172 and 174 of the flight-path-deviation switching system depends upon completion of a circuit through or around the hook and slice selector switch 202.

In the construction and operation of switch 202, the sleeve 26 carrying the ball support spindle 12 serves also as a mounting for the fixed con-

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tacts 206 and 208 of switch 202. As shown in Figure 6, these contacts are carried at the lower ends of spring fingers 210 and 212, which are supported at their upper ends respectively by the insulating posts 214 and 216 or other suitable supports fixed to the side of sleeve 26 near its lower end. The switch arm or blade of switch 202 comprises the normally vertical spring fingers 202' electrically interconnected and connected to lead 220, supported by their upper ends on posts 218 mounted on the same side of sleeve 26 near its upper end, and carrying at their lower ends switch contacts engageable with the contacts 206 and 208. The lead 220 and the leads 221 and 223 extending to contacts 206 and 208 are sufficiently flexible to prevent their interfering with the swinging movement of the spindle in either direction on its bearings 20.

The lower end of the spindle carries a lug 28 of insulating material received between fingers or leaves 202' as shown in Figure 6. When the spindle is turned, the lug 28 presses against one or the other of the fingers 202', depending on the direction of such turning, to move such finger into contact with its complemental stationary contact 206 or 208. As explained previously, such turning of the spindle is effected by striking the ball element 10 with a hooking or slicing stroke. Owing to the resistance to deflection of the fingers 202' by lug 28 bearing against them, such contacts will not be closed unless there is a substantial hook or slice tendency in the manner of driving the golf ball, and by appropriate selection of the spring fingers 202', or by adjusting the relative positions of contacts 206 and 208 and their opposing contacts carried by the fingers 202', the amount of hook or slice necessary to close switch 202 may be selected at any desired value.

The spring leaves 202' are sufficiently stiff to return the lug 28 to its neutral position. Moreover, fingers 210 and 212 are made relatively flexible in order to minimize the shock of engagement of fingers 202' with contacts 206 or 208 when the spindle is turned violently, and to increase the contact dwell time during conjoint flexure outwardly and inwardly of one of spring fingers 202' and its corresponding finger 210 or 212. The interval thus provided is sufficient for one of the holding relays 190 and 194, corresponding respectively to hook and slice contacts 206 and 208, to become energized despite any circuit gaps which may exist during the time required for the deflection switch contacts to move between successive switching positions. Other switching apparatus could be used in lieu of switch 202 to produce indications of different degrees of hook or slice should such indication be desired.

Relay 184 and holding relays 190 and 194, together with the hook-or-slice switch 202 coact together with the distance-indicator switching system to control the illumination of the display board. With switch 204 in its normally closed position the switch arm of switch 202 is energized from lead 186, and when it is moved to the right or left into engagement with either of contacts 206 or 208, respectively, which occurs when the driven ball is struck with either a hook or slice, a circuit through the lighting system and the flight path deviation switching system will be formed through the field of either of relays 194 or 190, energizing such relay. As holding relays, their contacts close with energization of their fields and thereafter continue to hold

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closed their field energizing circuits until such fields are deenergized by some other means, in this case the disengagement of all of switch contacts 150. At the instant one of these circuits is completed through such relays, normally closed relay 184 is energized to open its switching contact and deenergize the wire 182.

If it be assumed that a ball is struck with leftward deviation, producing engagement of the left movable contacts 170, 172 and 174 with the second row of stationary contacts 170', 172' and 174', and with sufficient hook to close switch 202 to the left in Figure 11, energizing the contact 206, and further that the first or inmost of contacts 150 is engaged by follower plate 66, then the lowermost light to the left of the light system shown in Figure 11 will be illuminated. The circuit for that light includes lead 156, wire 158, the light, the second of stationary contacts 174', movable contact 174, lead 192, the field of holding relay 194, initially lead 221, contact 206 and switch 202, but finally the contacts of relay 194 as that relay closes, and the field coil of relay 184 to the lead 186. With the closing of this circuit, relay 184 becomes energized immediately, which opens its contacts, thereby precluding the middle line of lights of any group in the system from being illuminated through lead 182, at the same time that a left or right line, corresponding to a ball driven with hook or slice, is illuminated.

In another instance the ball may be struck without hook or slice and without deviation to left or right from the path of aim, in which case, neither of relays 190 or 194 will be energized, and the contacts of relay 184, which also remains deenergized, will therefore remain closed. The inmost of contacts 170' and 176' will remain engaged by their respective movable contacts 170 and 176, forming a lighting circuit by way of switch 184, through one or more lights in the middle line of the central group of lights 146' and their corresponding contacts 150, switch plate 66 and energizing lead 156.

In still another instance a ball may be struck without slice or hook, but with deviation to the right. In this case as well, relay 184 will remain unenergized and its contacts closed, but moving contacts 176, 178 and 180 will be advanced to the right into engagement with the second of their stationary contacts 176', 178' and 180', or to a more remote group of contacts if the deviation is great and the control and lighting circuits are constructed with added groups of path lines in the board. With the second of contacts 176' engaged, a circuit then exists through the middle line of lights of the group 148', the number of lights illuminated in such line again depending upon the position of follower plate 66.

In the event that the ball has been struck with a hook or slice of sufficient magnitude to energize one of relays 190 or 194, it becomes necessary to deenergize such relay in order to restore the circuit to its initial condition. This is carried out automatically by withdrawing the follower plate 66 from engagement with all of contacts 150 when the apparatus is set by energizing the solenoid 128. Alternatively, with a solenoid employed to reset the indicator switching devices, raising the golf ball element 10 into teed position by swinging spindle 12 upward, could be effected by a separate solenoid or other suitable means.

Having described my novel practice driving apparatus with one type of display device, I wish

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it to be understood that various modifications and alternative forms of indicating mechanism may be employed without departing from the principles of the invention defined in the claims.

I claim as my invention:

1. Golf practice driving apparatus comprising a ball element, a normally erect support for the ball element, means mounting said support at its base for swinging of its upper end carrying the ball element, both forward and sidewise from its erect position, upon said ball element being struck by a golf club in either such direction, actuating means connected to said support and movable thereby, a pair of members cooperating with said actuating means and disposed for engagement selectively by movement of said actuating means upon sidewise swinging of the ball element support in one direction or the other, respectively, and separate deviation indicating elements guided for displacement selectively by movement each by a different one of said members, to indicate by such displacement, sidewise deviation from a reference path of the direction in which said ball element is driven.

2. Golf practice driving apparatus defined in claim 1, and separate electrical switch-contact members operatively engageable by the respective separate deviation indicating elements, and guided for movement conjointly with such respective elements into displaced positions related to the deviation component of force imparted by a golf club to the ball element struck thereby, and switch contacts arranged in groups stationed along the respective paths of movement of said switch-contact members, to be engaged successively thereby.

3. Golf practice driving apparatus comprising a normally upright ball element support rod mounted at a lower portion thereof for universal swinging about two generally horizontal axes, one disposed transversely of the direction of drive and the other generally parallel to the direction of drive, a ball element fixed to the swinging upper end of said rod, simulating a teed golf ball when said rod is disposed in upright position, a journal mount carrying said ball element support rod for rotation thereof about its own axis, said journal mount in turn being mounted for swinging of such rod about the two-named generally horizontal axes, "hook" indicator means and "slice" indicator means carried by said journal mount, and indicator actuating means carried by said ball element support rod to engage and actuate one of said indicator means by self-rotation of said rod in one direction or the other, respectively, caused by spinning of the ball element struck a glancing blow by the golf club.

4. Golf practice driving apparatus comprising a normally upright ball element support rod mounted at a lower portion thereof for universal swinging about two generally horizontal axes, one disposed transversely of the direction of drive and the other generally parallel to the direction of drive, a ball element fixed to the swinging

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upper end of said rod, simulating a teed golf ball when said rod is disposed in upright position, displaceable impact-receiving means disposed to receive the impact of the struck ball element after its supporting rod has swung downward about the first-named axis through an angle sufficient to clear the moving golf club, deviation-responsive means displaceable by swinging of said rod about its second-named axis when the ball element is struck a deviating blow, follower indicating means displaceable unidirectionally by displacement of said deviation-responsive means, but returnable independently thereof to its initial position, follower distance-indicating means displaceable unidirectionally by displacement of said impact-receiving means, but returnable independently thereof to its initial position, and resetting means cooperating with both of said follower-indicating means and with said ball element support rod and operable to return such follower-indicating means to their initial positions and said support rod to its erect position simultaneously.

5. Golf practice driving apparatus comprising a normally upright support, universal bearing means mounting said support for swinging thereof downward from an upright position in any of various directions, a ball element fixed to the swinging upper portion of said support, simulating a teed golf ball when said support is in upright position, and swingable downward on said support in a direction depending upon the direction of impact on the ball element of a golf club striking the same, yieldable impact-receiving means disposed to be struck by said ball element swung downward through an angle sufficient substantially to clear the moving golf club, said impact-receiving means being elongated in a horizontal direction generally perpendicular to the selected normal direction of drive, for receiving the full impact of the ball element when driven in any direction within a substantial range of directions departing to both sides of the selected normal and said impact-receiving means being mounted to swing downward about an axis which substantially coincides with the axis of swing of the ball element when struck in the selected normal direction, and spring means operable to resist yielding displacement of said impact-receiving means upon impact of the ball element therewith.

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