April 15, 1969 E. B. NICHOLS ET AL 3,438,257

GOLF PRACTICING APPARATUS

Filed June 17, 1965 Sheet 1 of 2

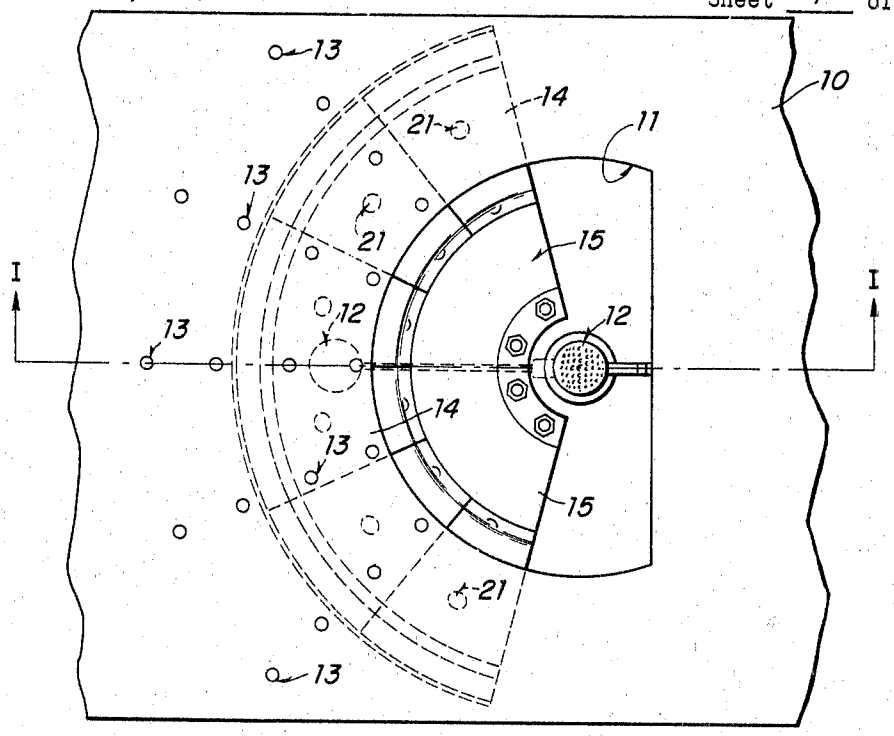


FIG. I.

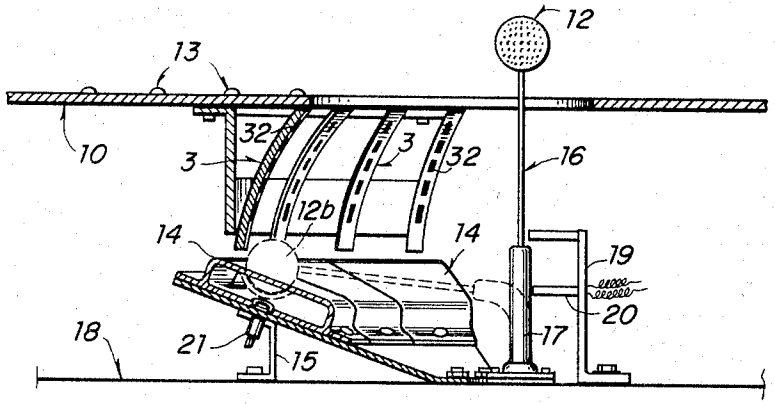


FIG. II.

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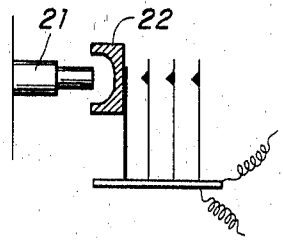


FIG. III

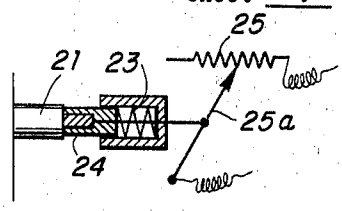


FIG. IV

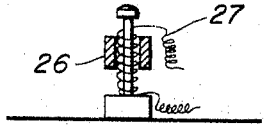


FIG. V a.

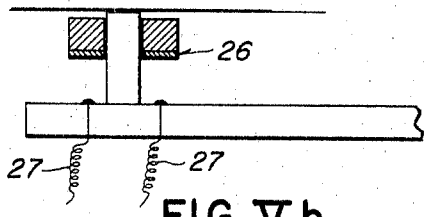


FIG. V b.

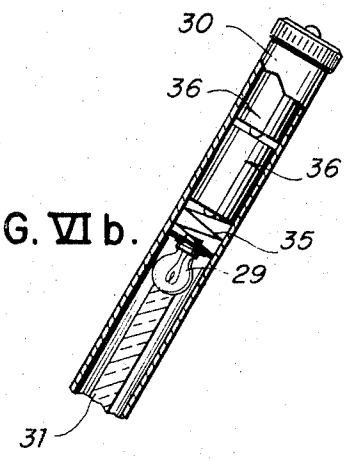


FIG. VI b.

FIG. VI a.

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GOLF PRACTICING APPARATUS

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Int. Cl. G011 *5/02;* A63b *53/04*

U.S. Cl. 73—379 5 Claims

ABSTRACT OF THE DISCLOSURE

A golf practicing apparatus having a golf ball, mounted in normal playing position, tethered and limited in simulated flight to prescribed arcuate paths, means to analyse a particular path, flight velocity and means to advise the player thereof.

This invention relates to golf apparatus for practice, amusement, instruction and/or competitive use in the game of golf and more particularly relates to apparatus that is used in association with a machine for simulating the game of golf and recording the accuracy with which the player strikes the ball. This application is cognate with E. B. Nichols' copending application Ser. No. 251,172 filed Jan. 14, 1963.

Electronic golf drive interpreters have been described in the art in accordance with which a captive ball is struck by the player with a golf club, a simulated fairway, traps, and green being positioned in front of the player, with means for showing visually thereon the distance, direction, and quality of his stroke; whereby the player is informed of the distance to which, the direction in which, and the hook, slice, or straightness with which an actual golf ball similarly struck might have been carried by the stroke. In the operation of such devices, repeated impacts of the club against the ball are extremely destructive. The blow of the club head on a captive golf ball is greater than that received by a free ball since the latter is not restricted in its movement but is free to fly in any impelled direction. The captive ball and the mechanism that holds the ball to the recording device are due to the repeated blows of the fair and also the misdirected strokes of the club, useable for only a relatively short period of time. Moreover, devices of the art fail to record with the desired accuracy functions performed by the stroke e.g. the force of the stroke, the distance the ball would have been driven, and the direction the ball would have taken. Objects of the present invention are to provide impact receiving units of the aforesaid general class that perform improved functions and that have a reasonably long life.

Other objects of the invention include: means for improving the utility of golf practice interpreters; means and methods for increasing the longevity of captive golf balls; the provision of ball holding means which function more completely and last longer than units of the prior art; the provision of means for following and precisely measuring the path taken and the speed of a captive golf ball after being struck by a golf club as well as improved means for correcting errors of the player and improving his golf swing. Other objects and advantages of the invention will hereinafter appear.

In copending application ibid. are described methods of mounting a captive golf ball, and provided stroboscopic and other means of determining indirectly its path and speed after being hit by a golf club in simulated play.

Improvements in such apparatus are provided by the instant application. For example, the ball in its captive flight scans a surface susceptible of being activated by a moving object, the ball, being adapted and arranged with means for effecting the activation such for example as light rays, mechanical, electromagnetic, ionic, pneumatic or any suitable activating source capable of identifying the path taken by the ball after the stroke. Moreover, means are also provided to absorb the destructive forces imparted to the ball thus reduced wear and tear on the ball, its mounting and the associated apparatus.

The invention will be more particularly described by reference to the accompanying drawings, of exemplary embodiments, in which like parts are identified by like numbers throughout.

FIG. I is a top plan view of a playing floor through which a golf ball protrudes ready for use, and in which devices are embedded for detecting the path taken by the golf club head as it passes over the floor. Suitably positioned below the floor are means for stopping the ball and recording the forces absorbed by the deceleration.

FIG. II is a view in cross section along I—I of FIG. I revealing the impact pads in which the force of the ball is absorbed; associated means for measuring the force with which the pad is deflected and pneumatic means are positioned below the floor for detecting the direction and force imparted to a golf ball in simulated play. Alternatively, detecting devices, such as photosensitive cells, radar, sonic and supersonic devices (with suitable wiring well known in the art and not shown in FIG. II), are positioned above the floor for following the swing of the golf club and below the floor for following the direction taken by the captive golf ball during play. Detecting devices described supra are shown below the floor in FIG. II and are not shown in FIG. I for simplicity and ease of following FIG. I.

FIG. III and FIG. IV provide diagrammatically drawings of pneumatically activated means for relaying electronically the effect of the golf stroke with respect to direction and force to a suitable recorder not shown.

The accompanying drawings depict arrangements of apparatus and embodiments of the invention that provide ways not only of simulating a game of golf but also of analysing the skills of the player, of accurately measuring the force of his stroke, of plotting the probable path of the golf ball were it free to fly, but also of diagnosing both the errors of the player's swing as well as the good, bad or indifferent point of contact of the club with the ball. Features of the invention that permit such instructive golf play include, inter alia, the measurement of the velocity and direction of the golf ball after being struck.

A more precise understanding of the invention will be understood by reference to the accompanying drawings which illustrate without limiting the scope thereof.

Briefly the invention relates to an apparatus for use in playing a game of golf in a restricted space and with the advantages of the game such as, for example, muscular coordination and improved tone while at the same increasing stroke accuracy with respect to power and direction, all these without the loss of time usually attending the compulsive traveling between shots required in normal play. The apparatus comprises in combination a golf ball mounted on a flexible shaft, the ball being positioned at the proper distance above the playing surface for striking with the golf club in the usual manner of play. After being struck by the club, the golf ball, which has a wide

freedom of movement, follows an arcuate path in compliance with the direction and force imparted to it by the stroke of the club and within the freedom of its captivity. Interposed in approximation to the paths of the ball and the club are positioned devices that detect the paths taken by the ball, detecting devices being adapted and arranged with suitable recording mechanisms for visually illustrating the manner of play for viewing by the player.

Referring to the drawings and particularly to FIG. I, numeral **10** designates a playing floor with an opening therein **11**, a captive golf ball **12** protrudes above the floor level. Radiating from the position of ball **12** at rest are sensing devices **13** fixed on or embedded in playing floor **10**, which are used for measuring the speed and direction of the golf club, not shown in this view, after the club has made contact with the ball, and when club is in what is termed "the follow through." Positioned below the floor are impact pads **14** for stopping the motion of the golf ball **12** as it is forced into its restrictive path of simulated flight. Brackets **15** are provided also below the playing floor **10** for holding the impact pads **14** in proper position to receive the ball **12** and to stop its motion, these pads will be more fully described infra.

Referring now to FIG. II, ball **12** is fixed to the upper end of flexible steel shaft **16**, the lower end of shaft being fixed to a more flexible synthetic elastomeric rubber-like support **17** more specifically described in copending application Ser. No. 251,172 filed Jan. 14, 1963, now abandoned, which is firmly attached to lower floor **18**. A steel bracket **15** supports impact pads **14** above floor **18** and at a decided angle say an angle of 20 to 30° with floor **18**. Applicants have found that the angular positions of pads **14** are far superior to horizontal positions, heretofore used in such devices. By use of the angular position, destructive retardation forces are resisted, by ball **12**, shaft **16**, support **17** and a pad **14**, with markedly reduced wear and tear on equipment. Stop **19** for the rebound of the ball-shaft-support structure is provided with an electrical switch **20** for indicating the beginning of the stroke. Elapsed time between the tripping of switch **20** and the striking of pad **14** is calibrated by suitable well known means and the player advised by visual means not shown in the drawing of the length of his drive. As the ball strikes any one of the plurality of pads **14**, which are constructed to receive the ball, to stop the ball's forward motion and to measure the force of the stroke imparted to the ball by the golf club swing of the player, the pad is compressed in extent proportional to the force of the stroke. The pad is made of a flexible material such as a synthetic elastomeric substance, rubber or like suitable material, of a suitable shape as shown to enclose a sufficient volume of air for absorbing the blow of the ball before the upward layer of pad **14** touches the lower layer thereof. Aperture **21** is provided to discharge the air displaced by the impact from the pad. By suitable devices described infra (and as an alternate of those described supra), the amount of air discharged and the velocity of the air during its discharge is analysed and shown by suitable visual signals to the player wherefrom he can judge the force of his stroke and/or the distance the golf ball in unsimulated flight would travel, with or without a normal amount of roll.

FIG. II illustrates a complementary and/or alternative means of analysing the direction and force of the golfer's stroke. Below the floor **10** are positioned a plurality of sensors **32**. Sensors **32** are placed on or in a suitable support or supports as shown that follow arcuate paths approximating the paths taken by the ball after it swings below floor **10**. Sufficient sensors **32** are embedded on supporting members **3** to follow all paths taken by the ball. In place of the sectional type of supporting members **3** a section of a spherical surface, not shown, of appropriate size to be in proximity to all paths taken by the ball, can be used in which sensors are embedded to insure by appropriate number and orderly positioning the precise determination of the direction of the ball and/or its velocity as it passes between floor **10** and pad **14**. The arcuate paths of a plurality of balls form an intangible segment of a sphere the radius of which is proximate to and less than the radius of the sensory segment; as is illustrated by the drawing FIG. I and FIG. II. These sensors, whether mechanically, electrically, vibrationally (i.e., by ionic, light or like activating rays), magnetically or otherwise activated by appropriate means located in the ball, trace the ball's path. The course of the ball is thus followed, the course being recorded and visually positioned on an appropriate map of the golf course or otherwise to inform the golfer of the precise effects of his swing and the path, if any, a golf ball similarly struck in the normal course of play would have taken. The sensors **32** to the course taken by the ball to provide a meticulous analysis of the playing of the golfer and make it possible for him to perfect his play. Means of transferring the information is well known see, for example, U.S. Patent of McNeill 3,020,049 of Feb. 6, 1962.

FIG. III and FIG. IV are symbolical drawings of respectively electrical contacting and variable rheostatic means of analysing the force with which the golf ball hits impact pad **14**. FIG. I shows a plurality of pads **14** any one of which may be hit according to the direction the ball is driven by the club. Each pad **14** is provided with an aperture **21** suitably placed for delivery of the air driven from the pad to suitable means provided (as for example, the embodiments of FIGS. III and IV) to measure the velocity of the ball. In FIG. III the delivered air being forced into the flexibly mounted cup **22** forces the cup against the electrical contacts, the contacts closing one after the other according to the force of the air delivered to the cup. In FIG. IV spring **23** holds plunger **24**, which fits loosely in aperture **21**, inside said aperture, the force of the air actuates the variable resistor **25** by operating the arms **25***a* shown. The resulting variable impulse is electrically connected to suitably calibrated potentiometer which shows the force of the ball in any suitable manner.

In the manufacture and use of apparatus for the practice of golf such as is shown for example in the U.S. Patents 2,897,674 and 3,020,049 and others, simulated golf balls are anchored to permit only a relatively few degrees of free movement. The repeated impacts of the club head against the ball have cutting, displacing, compressing, and other disruptive effects, especially when the ball is struck blows that, were the ball free to move in all directions, it would take a direction other than that permitted by the apparatus. The utility of such apparatus is limited by the frequency with which the golf ball and the associated structure must be renewed and replaced. In accord with the present invention it has been found that by providing the improved simulated golf ball, its associated structure and the golf club hereinafter described, not only can the utility, durability and efficiency of the apparatus be increased but also the fidelity with which the apparatus interprets the accuracy of the player can be markedly improved.

Golf driving interpreters as have been shown are subject to loss of monetary return to the operator of the device and the loss of accuracy in measuring and duplicating visually the stroke for the player. Retention of initial ball and club dimensional stability and surface resilience are prerequisites to successful exploitation and use of such devices. Applicants have found that by fabricating the club head, the ball and the resilient base members of a specific type of synthetic moldable and/or castable elastomer and also by providing the striking parts of a prescribed hardness, their utility in combination is surprisingly improved in flexibility, toughness, stability, abrasion resistance and longevity.

For optimum utility in the aforesaid respects those parts of the assembly have these properties:

(1) Ball **12** is made from a vulcanizate of urethane resin [a] with methylene-bis-orthochloroaniline by the process described below, the vulcanizate having a Shore A durometer [b] hardness of 94 to 97 and preferably about 95.5.

(2) Support **17** is made from a vulcanizate of urethane resin [c] with methylene-bis-orthochloroaniline by the process described below, the vulcanizate having a Shore A durometer hardness of 86 to 90 and preferably about 88.

The vulcanizates are prepared by mixing (in mixing equipment designed to homogenize liquid polymers) 10 to 30 parts and preferably about 15 parts by weight of methylene-bis-orthochloroaniline to 100 parts by weight of the resin. The mixture may be heated to about 100° C. to facilitate pouring and then is charged into a suitable mold to form the ball on the shaft **16** and into a mold adapted and arranged in the customary manner to form a club head **33** on shaft **31**. The composite mixture can be processed by the well known plastic gum technique. The composite is cured in the mold with sharp detail at 300 to 400° F. and preferably 350° F. with pressure of 1,000 to 2,000 and preferably 1,500 p.s.i. for from 10 minutes to 24 hours.

Urethane elastomers generally having the aforementioned properties may be used in the preparation of the products of the invention. The art teaches a variety of vulcanizing agents that can be used such as the alkylene halogenated anilines and alkylene substituted aniline homologues such as the corresponding substituted orthotoluidine and para-toluidine and especially such vulcanizates having the superior engineering properties conforming to those described by J. G. DiPinto and S. D. McCready in "Development Products Report No. 17," April 1960 of E. I. du Pont de Nemours & Co.

The invention is however not specifically limited to the details described above nor to the apparatus or structures described in the drawings. Many modifications on the contrary may be made within the purview of the invention without departing from the subject matter as set forth in the appended claims.

We claim:

1. A golf apparatus comprising a universal pivot, a rod having a simulated golf ball at one end, and a plurality of sensors for indicating the direction of the simulated ball when struck by a golf club, wherein the rod is positioned upright upon the universal pivot and supports the simulated golf ball at its upper end, said simulated golf ball being free to move in one of several arcuate paths about the universal pivot when struck by a golf club, and said plurality of sensors all being positioned equidistantly from the pivot just beyond the radii circumscribed by the ball when it is struck, so that any one of the several paths about the universal pivot that may be circumscribed by the struck ball can be sensed to indicate the direction which the simulated ball has taken.

2. A golf practicing apparatus designed to have a golfer strike a simulated golf ball with a golf club, and to observe the direction and distance that a golf ball in normal play would have by a comparable stroke, wherein said apparatus comprises a universal pivot, a rod having a simulated golf ball at one end, a plurality of sensors for indicating the direction of the simulated ball when struck by a golf club, pads to receive the simulated ball at the end of its travel and means to record the impact of the ball upon the pads as a measure of the distance of a comparable golf drive, said rod being positioned upright, upon the universal pivot and supporting the simulated golf ball at its upper end, said simulated golf ball being free to move in one of several arcuate paths about the universal pivot when struck by a golf club, and said plurality of sensors all being positioned equidistantly from the pivot just beyond the radii circumscribed by the ball when it is struck, so that any one of the several paths about the universal pivot that may be circumscribed by the struck ball can be sensed to indicate the direction which said ball has taken.

3. The golf practicing apparatus of claim **2**, means of activating the sensors when the golf ball passes in proximity to the sensors.

4. The golf practicing apparatus of claim **2**, flexible pneumatic pads angularly positioned to greater than about 70° with respect to a vertically positioned golf ball support at rest.

5. The golf practicing apparatus of claim **2** in which the golf ball and the golf head are molded from a urethane elastomeric vulcanizate.

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152,905	8/1953	Australia.

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ROBERT S. SALZMAN, *Assistant Examiner.*

U.S. Cl. X.R.

273—183

[a] This resin is a reaction product of diisocyanate and a polyethylene ether glycol having a viscosity of 6,000 to 8,000 cps. at 30° C. and has a specific gravity of 1.06. (Adiprene L–197 of Du Pont is a suitable equivalent.)

[b] Shore A test procedure is by ASTM D–676.

[c] The resin is a reaction product of diisocyanate and a polyethylene ether glycol having a viscosity of 14,000 to 19,000 cps. at 30° C. and has a specific gravity of 1.06 (Adiprene L–100 of Du Pont is a suitable equivalent.