United States Patent [19]

Nicolaides

[11] **3,777,548**

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[54] **GOLF BALL TESTING AND DEMONSTRATING APPARATUS**

[76] Inventor: **John D. Nicolaides,** 3020 Buckingham Dr., South Bend, Ind. 46614

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[52] **U.S. Cl.** **73/12**
[51] **Int. Cl.** **G01n 3/30**
[58] **Field of Search** 73/13, 12

[56] **References Cited**

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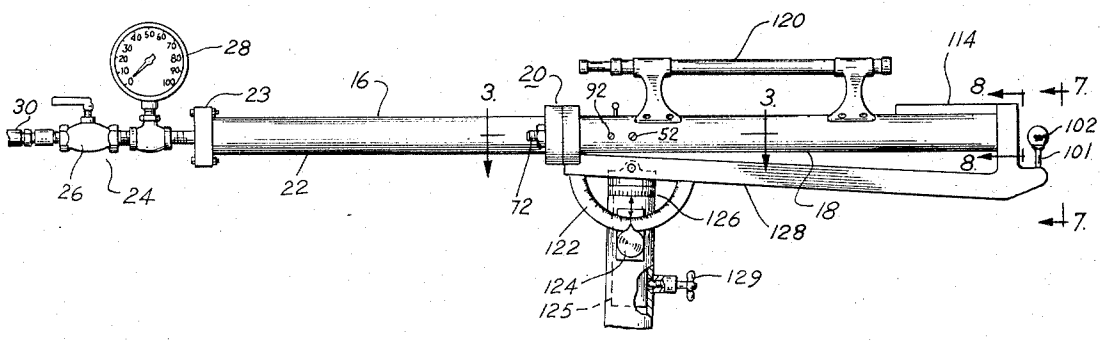
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Primary Examiner—James J. Gill
Attorney—Marmaduke A. Hobbs et al.

[57] **ABSTRACT**

A golf ball testing and demonstrating apparatus in which a projectile having a ball striking forward face thereon is propelled through the barrel by pressurized gas released from a chamber at the breech end of the barrel. The gas is preferably retained in the chamber at the breech end of the barrel by a diaphragm, and a means is provided at the breech end of the barrel for piercing the diaphragm when the apparatus is to be operated, thereby instantaneously releasing the gas and propelling the projectile forwardly to strike a golf ball positioned at the muzzle end of the barrel. The barrel may be rotated and adjusted at vertical and horizontal angles to obtain variations in the flight pattern of the golf ball propelled by the apparatus. Further, the projectile face angle may also be rotated at various vertical and side angles in order to obtain variations in the flight pattern of the golf ball for producing hook, slice, fade, drop and push and other conditions normally encountered in playing golf.

17 Claims, 15 Drawing Figures



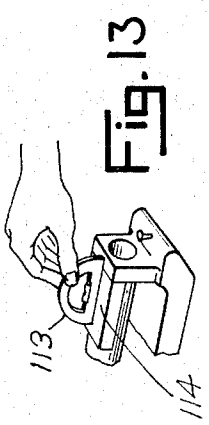


Fig. 13

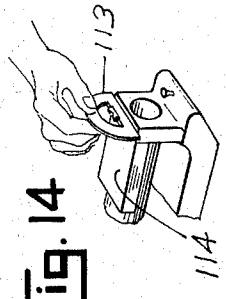


Fig. 14

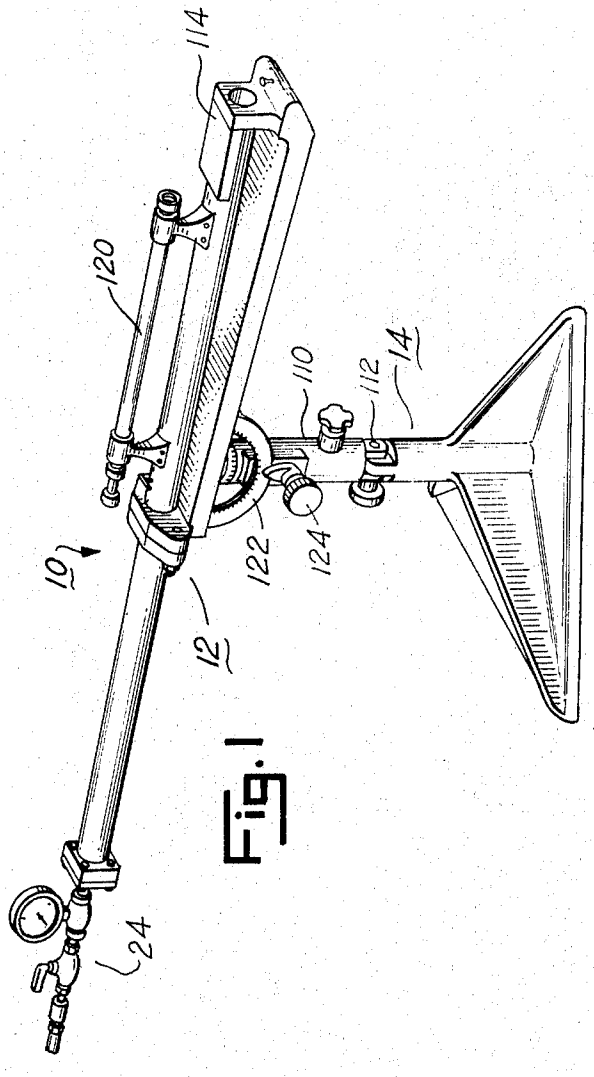


Fig. 1

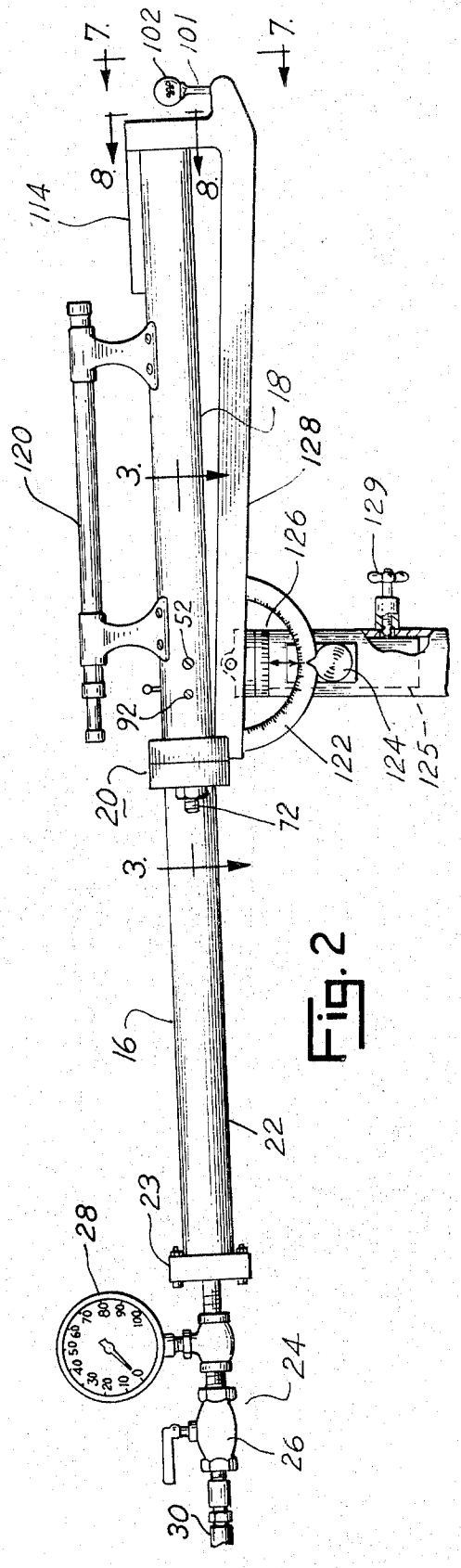


Fig. 2

Fig. 3

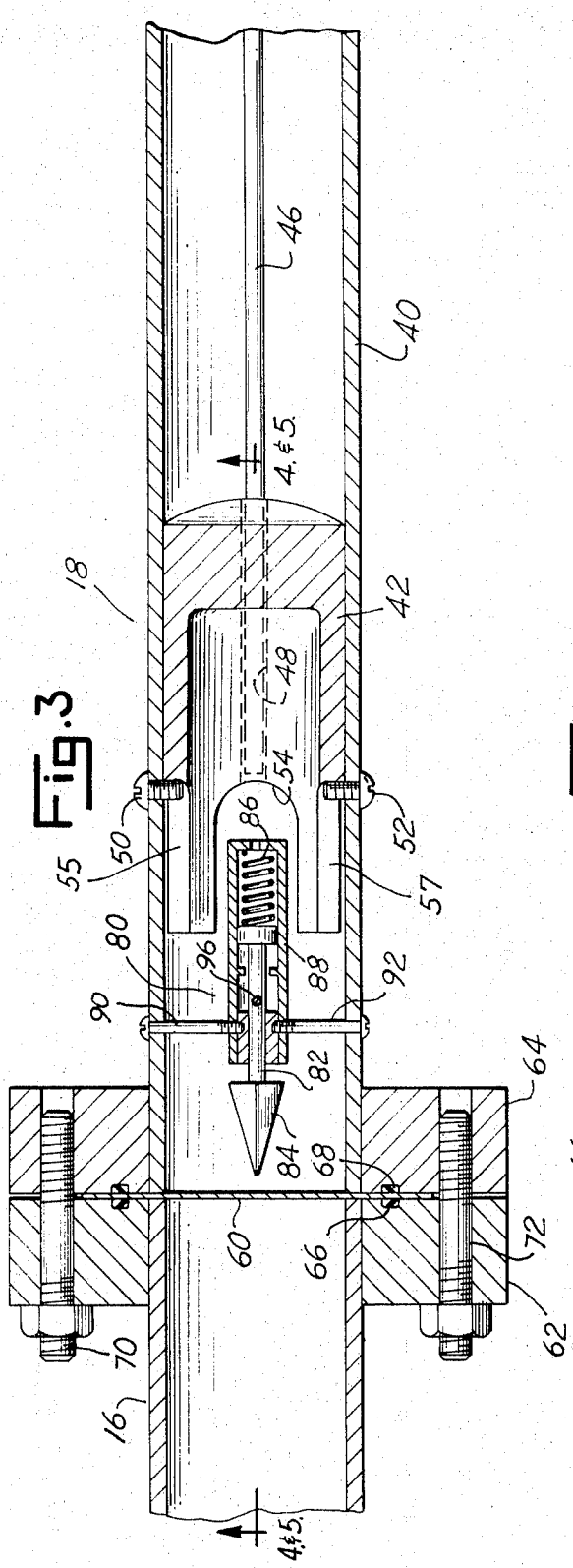

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Fig. 6

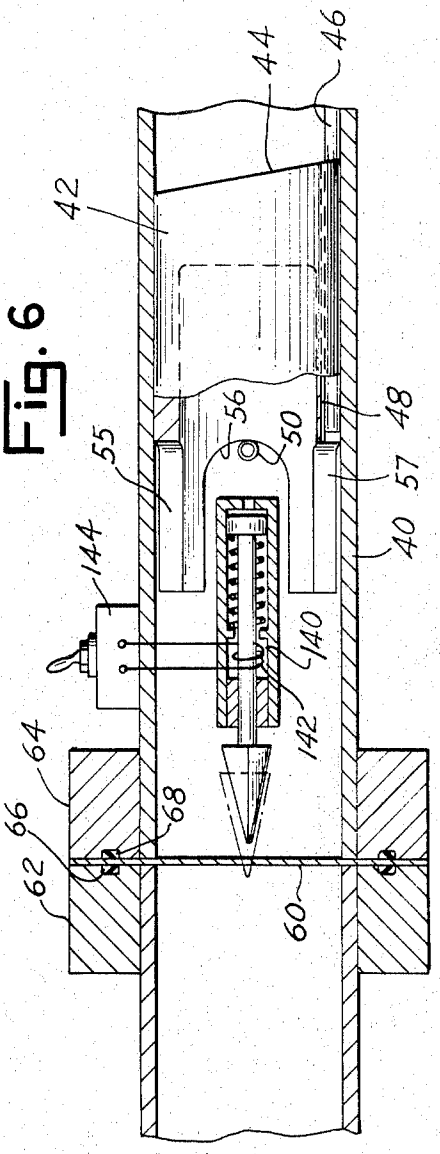

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Fig. 15

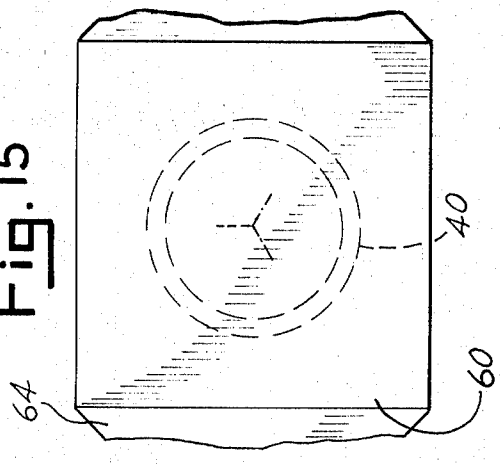


Fig. 4

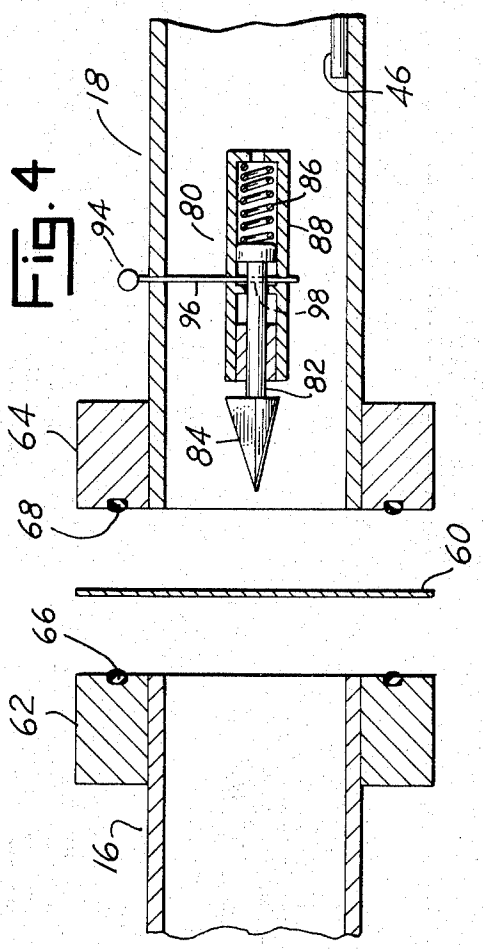


Fig. 5

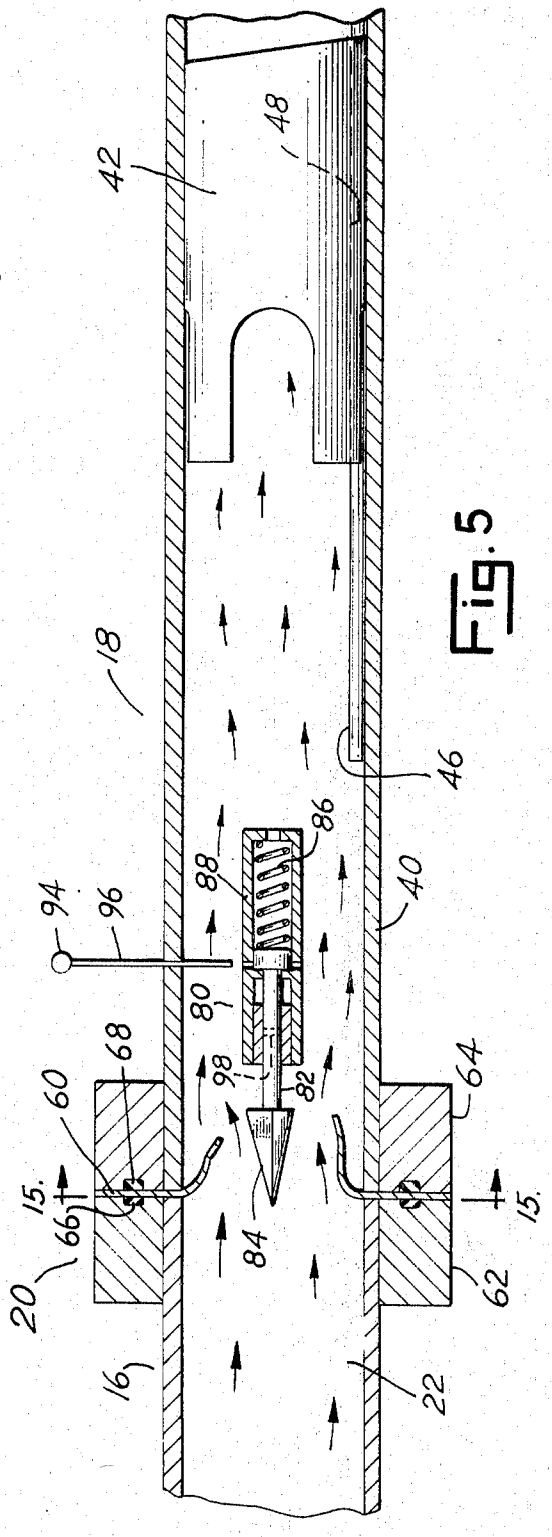


Fig. 7

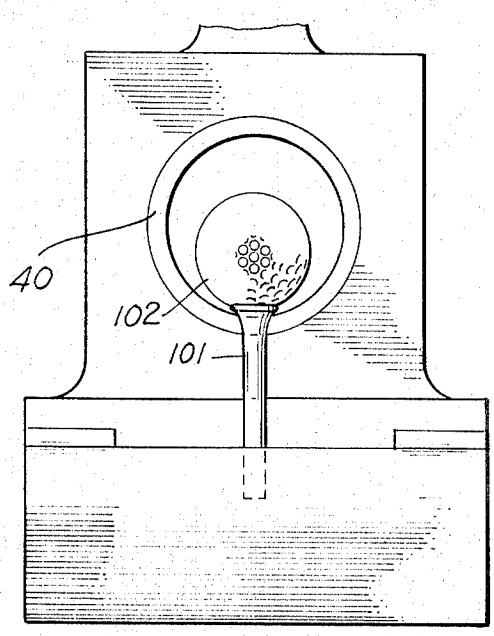


Fig. 8

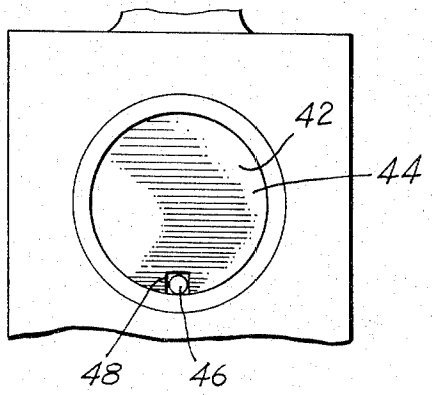


Fig. 9

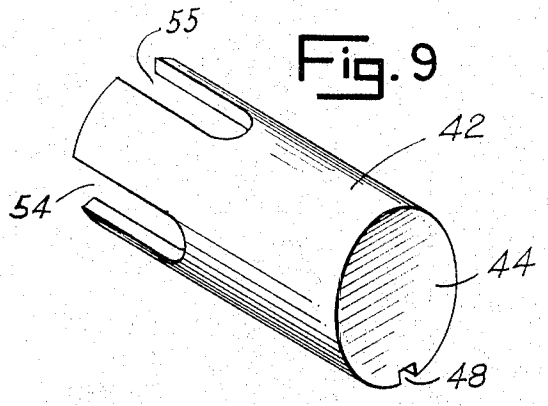
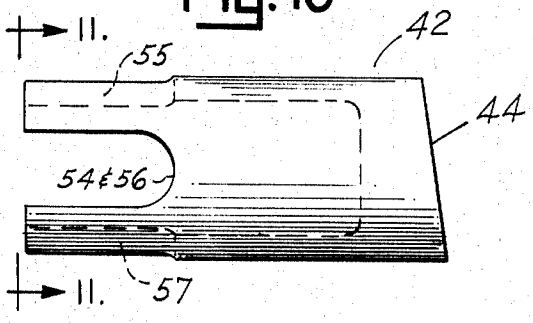


Fig. 10



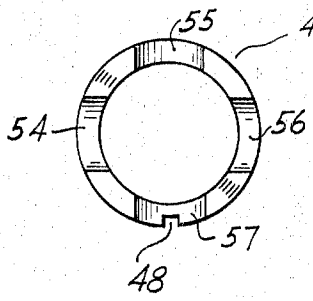
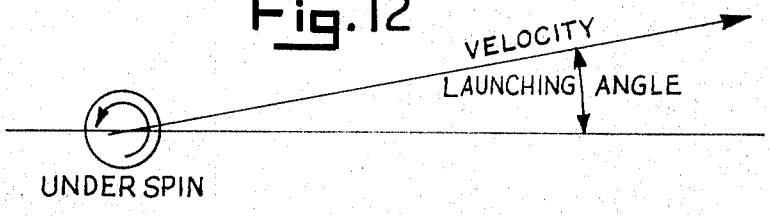


Fig. 11

Fig. 12



GOLF BALL TESTING AND DEMONSTRATING APPARATUS

In testing the flight of golf balls, accurate control of the initial launching conditions and the aerodynamics of the flight configuration are of primary importance and are essential to achieve optimum flight characteristics of the ball and reproduceable and reliable test results. In order to launch a golf ball properly and to simulate actual driving conditions in a test program, the ball must be given the proper velocity, the proper launching angle and the correct underspin, and each of these factors must be effectively maintained and controlled throughout any comparative testing program if the test results are to indicate reliably the flight characteristics of the balls tested. Precise control ot these factors is likewise of critical importance in driving the ball during the game if maximum flight and proper direction are to be obtained. For example, improper underspin resulting from a hook or slice causes the ball to travel substantial distances to the right or left during an actual drive. The proper underspin elevates the ball and increases the distance up to as much as double the distance of a ball without or with poor underspin. The underspin is primarily controlled by the angle of the face of the club or projectile striking the golf ball, and the effectiveness of the underspin on the flight of the ball is controlled to a significant degree by the surface configuration of the ball.

In golf ball testing programs in the past, generally mechanical launchers utilized an actual golf club or an arm or pendulum simulating a swinging golf club, and the force for operating the club or arm was provided by a spring or a combination of springs. These launchers have been purely mechanical, involving the use of various constraints, springs, rotating axes and flexible shafts, any one or all of which have rendered the launchers extremely inaccurate and incapable of giving reproduceable and reliable test results. For example, the arm swinging type of launcher introduced large variation in velocity as a result of the random compression of the spring, the friction between rubbing parts, and the expansion and shrinkage of the metal parts under various operating conditions. Further, because of the effect of the weight of the head on the arm during acceleration of the head toward the ball, the arm would tend to bend and twist, thereby introducing additional factors and variations in the launch spin axis. The prior testing apparatus inherently failed to have separate and complete control of the three important launching conditions of velocity, angle and underspin, thus preventing full and precise control of the test parameters.

It is therefore one of the principal objects of the present invention to provide a golf ball testing and demonstrating apparatus which is so designed and constructed that the factors of velocity, launching angle and underspin of the ball can be independently and accurately controlled to obtain optimum or other selected flight performance of the test balls, and which will give reliable and continually reproduceable test results under exacting conditions.

Another object of the invention is to provide a golf ball launching apparatus for use in testing programs which will produce precisely the same ball velocity on every shot for any particular adjustment of the apparatus, and which can provide a ball flight with no underspin or with various types of underspin to determine accurately flight characteristics of the ball and the aerodynamics required for maximum flight performance.

Still another object of the invention is to provide a testing apparatus for golf balls which can be utilized to determine the effect on the ball flight of the configuration and composition of the club head, such as the effect of lines, knurlings and notches on the face of the club and the use of metal, wood and plastic in the construction of the head, in order to assist in the development of optimum structures and designs of clubs, and which can readily be adjusted to obtain various driving conditions and ramifications relative to one primary factor while retaining the other factors constant.

A further object is to provide a golf ball testing and demonstrating apparatus which is relatively simple in design, structure and operation, and which is sufficiently small and compact that it can be readily transported from one location to another for testing and demonstrating the performance of various makes and types of golf balls and for making comparative tests under various weather and golf course conditions.

Additional objects and advantages of the present invention will become apparent from the following description and accompanying drawings, wherein:

FIG. 1 is a perspective view of a golf ball testing and demonstrating apparatus embodying the present invention;

FIG. 2 is an enlarged view of the apparatus illustrated in FIG. 1;

FIG. 3 is an enlarged, fragmentary vertical cross-sectional view of the apparatus shown in FIGS. 1 and 2, the section being taken on line 3—3 of FIG. 2;

FIG. 4 is a vertical cross-sectional view similar to that shown in FIG. 3, but illustrating the manner in which the apparatus is assembled and prepared for use in a test;

FIG. 5 is a vertical cross-sectional view similar to that shown in FIG. 3, but illustrating the manner in which the apparatus is operated to launch a golf ball;

FIG. 6 is a vertical cross-sectional view similar to that shown in FIG. 5, illustrating a modified form for operating the apparatus to launch a golf ball;

FIG. 7 is a front elevational view of the apparatus shown in the preceding figures, showing a golf ball in position to be launched;

FIG. 8 is a fragmentary elevational view of the apparatus illustrating the position of the projectile used in the launching operation in position immediately before striking the golf ball;

FIG. 9 is a perspective view of the projectile seen in the preceding figure, removed from the apparatus;

FIG. 10 is a side elevational view of the projectile;

FIG. 11 is a rear elevational view of the projectile;

FIG. 12 is a diagram illustrating the primary factors controlled in the present golf ball launching device;

FIGS. 13 and 14 are perspective views of a gunner's quadrant used to position accurately the launching apparatus to obtain various ball launching angles and flight patterns; and

FIG. 15 is a vertical cross-sectional view taken on line 15—15 of FIG. 5.

Referring more specifically to the drawings, and to FIG. 1 in particular, numeral 10 indicates generally the present golf ball testing and demonstrating apparatus, numeral 12 and the launching portion of said apparatus, and numeral 14 a stand therefor. The apparatus illustrated in the drawings is capable of being readily

transported from one location to another and adjusted to obtain various launching and flight configurations. While the one shown is mechanically controlled, it may readily be converted to an electrically controlled type which can be operated remotely from the apparatus and may be adapted to operate under various weather and golf course conditions. The apparatus is designed to be used with a conventional golf ball and to reproduce conditions frequently encountered in a normal golf game.

The launching portion consists of a power section **16** and a projectile and ball launching section **18**, and two sections being secured together during operation by a coupling section **20**. The power section **16** consists essentially of a cylinder having gas chamber **22** and a rear end member **23** to which is connected a pneumatic air line **24**, the line having therein a manual control valve **26** and a pressure gage **28**. A flexible tube **30** connects line **24** with a source of air pressure such as, for example, an electrically operated pneumatic pump (not shown), capable of providing pressure up to at least **90** psi. The compressed air in chamber **22** constitutes the propellant for the projectile in section **18** when released by a mechanism hereinafter described. The cylinder may be constructed of steel or aluminum tubing and is capable of withstanding the required pressure and yet sufficiently light weight that it can be easily handled manually when the apparatus is being transported, assembled and used for test or demonstration purposes.

Projectile section **18** consists of a hollow cylinder or barrel **40**, such as a steel or aluminum tube, and contains a projectile **42** which is preferably constructed of aluminum and is adapted to move freely from one end of the barrel to another when the compressed air in cylinder **16** is released. The projectile is provided with a ball striking face **44** which, as shown in the drawings, has an upwardly and rearwardly extending angle similar to the face of a driver on a golf club. While the face is illustrated in the drawings as smooth, it may have one of a variety of different configurations such as lines, knurlings, dimples or notches, and the face may be a metal, wood or plastic layer on the projectile. Further, projectiles with different angles on the face may be substituted for the one shown, or a projectile with an adjustable forward end face be used if desired. The face angle may be rotated at various vertical and side angles in order to obtain variations in the flight pattern of the golf ball for producing hook, slice, fade, drop and push. The projectile is retained in an angularly fixed position relative to the barrel by a track **46** secured to the bottom of the inner surface of the barrel and a slot **48** in the lower surface of the projectile embracing the track and preventing rotation of the projectile in the barrel. The track and slot retain the projectile in a fixed angular position with respect to the barrel without interfering with the free movement of the projectile in the barrel. The diameters of the barrel and projectile are such that the projectile in effect forms a piston in the barrel without causing any significant restraining effect on the longitudinal movement of the projectile in the barrel. While a small amount of air may escape around the projectile, the amount relative to the entire amount of compressed air propelling the projectile is insignificant and has no adverse effect on the test results. However, the walls of the projectile at the trailing edges thereof may be made sufficiently thin, or a plastic ring may be inserted behind the projectile if desired, to function as an obturator to prevent the escape of any gas around the projectile. The projectile is positioned in the breech end of the barrel for firing by a pair of screws or pins **50** and **52** extending inwardly diametrically opposite to one another through the walls of the barrel near the breech end thereof, and the projectile is provided with four slots **54, 55, 56** and **57** which permit the projectile to seat near the breech end of the barrel without interfering with the operating and trigger mechanism disposed therein.

Air or other suitable gas is retained in the chamber in cylinder **22** by diaphragm **60** consisting of a thin sheet of metal such as foil or other suitable frangible material, which is clamped between flanges **62** and **64** on the adjacent ends of the power and projectile sections, respectively. A pair of O-rings **66** and **68** may be disposed in grooves in flanges **62** and **64** on either side of the diaphragm. When the two sections have been assembled, the diaphragm is held firmly in air-tight condition between the two flanges by a pair of bolts or studs **70** and **72** extending through holes in flange **62** into threaded holes in flange **64**. Other types of securing means may be used to couple the power and projectile sections together; for example, a hinge may be used on one side of the flanges and a hook or clamp on the other side to hold the two flanges firmly together with the diaphragm therebetween. However, a securing means which permits the two flanges to be separated and a new diaphragm inserted therein with a minimum amount of time and effort is desirable if a series of tests and demonstrations is to be conducted.

The mechanism for instantaneously releasing the compressed air in cylinder **16** is indicated by numeral **80** and consists of a shaft **82** having a sharply pointed multiple bladed head **84** thereon. The three bladed head shown in the drawings is driven forcefully toward and into contact with diaphragm **60** by a spring **86** in a cylindrical housing **88**, cutting or slitting the diaphragm to produce a predetermined puncture pattern, such as illustrated in FIG. **15**, thereby instantaneously releasing the gas from chamber **22 86** the barrel. The mechanism is supported in the center of the breech end of barrel **40** by screws **90** and **92** extending inwardly through the sides of the barrel and into housing **88**. The shaft **82** and the head are held in retracted position by a trigger **94** consisting of a stem or rod **96** extending inwardly through a hole in the side wall of barrel **40**, through the housing **88**, into a hole **98** in shaft **82**. When the shaft and head are retracted in preparation for a test, the shaft and head are pushed inwardly, compressing spring **96** and aligning the hole in the housing with hole **98** in the shaft and inserting stem **96** through the holes, thereby retaining the shaft and the head in their retracted positions as illustrated in FIG. **4**. When the diaphragm has been clamped between the two flanges **62** and **64**, as illustrated in FIG. **3**, and secured by bolts **70** and **72**, the firing mechanism is ready for the test.

A tee **101** is provided at the muzzle end of the barrel for supporting a golf ball **102** thereon at the center of the muzzle, but spaced a short distance therefrom. The tee may be adjusted to various positions in order to permit the barrel and/or the projectile to be rotated during the testing program and thereby change the angle or face of the club to correspond to a slice or hook on the club during a drive by a golfer. The rotation may be

performed by various ways; however, in the embodiment illustrated in the drawings, the post **110** of stand **14** on which the launcher is mounted, is provided with a pivot means **112** which permits the launcher to be placed at angles to either side from the vertical position. A quadrant placed in the two positions illustrated in FIGS. **13** and **14** on platform **114** at the forward end of the barrel is preferably used to obtain the precise angularity of the barrel on both transverse and longitudinal axes. A scope **120** is preferably mounted on barrel **40** in order to assist in aligning the launcher with the target in a position where the balls are expected to alight, the target normally being a stake or flag. A quadrant indicated by numeral **122** is preferably provided on the mounting means for the launcher in order to facilitate obtaining the desired longitudinal angle of the barrel. After an adjustment is made using the quadrant **122,** the adjustment is retained by a screw **124.** The horizontal angular position of the launching device may be varied by rotating telescopic shaft **125** in post **110.** The barrel is held rigidly on a frame **128,** which in turn is secured to the upper end of shaft **125.** Thus, the horizontal angularity of the barrel is adjusted by using scale **126** on the upper end of post **110,** and after an adjustment is made, it is retained in place by screw **129.** The tee **101** may be adjusted to accommodate minor rotations and tilting of the launching device when the device is set up for testing or demonstrating programs.

In the use of the present golf ball testing and demonstrating apparatus, the launcher **12** is mounted on stand **14,** and the angularity of the longitudinal and transverse axes of the barrel is adjusted with the use of gunner's quadrant **113** on platform **114,** as illustrated in FIGS. **13** and **14.** The barrel is accurately aligned with the target by the use of scope **120.** Either before or after the adjustment has been made, a diaphragm is inserted between flanges **62** and **64.** The discharge mechanism is cocked by withdrawing shaft **82** and head **84** to the position illustrated in FIG. **3** and held in that position by trigger **94** extending downwardly through holes **96** and **98.** With the shaft and head withdrawn and diaphragm **60** clamped firmly in place, the air under pressure is delivered to cylinder **16** until the pressure reaches, for example, 90 psi. After the cylinder has been pressurized and valve **26** closed and the source of pressure disrupted, valve **26** is then opened to reduce the pressure to the exact desired pressure for propelling the projectile. When the air is bled off to reach the desired psi, such as 85 psi, the trigger **94** is pulled upwardly, thereby releasing shaft **82,** permitting spring **86** to drive the shaft longitudinally and the head into diaphragm **60,** thus piercing the diaphragm and forming cuts therein, preferably of a star configuration. This instantaneously releases the air under pressure in chamber **22** and subjects the projectile to the pressure, thus driving the projectile through the barrel and outwardly from the forward end thereof, causing it to strike and drive ball **102.** The projectile strikes and drives the ball before the rear portion of the projectile has emerged from the muzzle of the barrel, so that precise control of the projectile is maintained until the ball is in flight. The three factors illustrated in FIG. **12** are operative in the launching of the ball for the test flights and are independently adjustable and controllable in the present apparatus.

As the ball is in flight, the one making the test observes the flight pattern, and the time and distance the ball is traveling. The projectile continues outwardly beyond the barrel and falls to the ground, and is then retrieved and reassembled in the barrel and a new diaphragm **60** is clamped between the two flanges in the coupling section preparatory to another test. The transverse and longitudinal angularity of barrel **40** may be adjusted by adjusting pivot means **112** and quadrant **122** so that varying conditions may be obtained in order to fully test a ball or a series of balls.

Various changes and modifications may be made in the launching device; for example, the launcher may be operated electrically from a position remote from the device. The device can be controlled electrically by substituting a solenoid operated means **140** for the mechanically operated means **80.** An electromagnet **142** is used to propel shaft **82** and head **84** in the direction to pierce diaphragm **60.** Switch **144** for controlling the coil in the electromagnet is shown mounted on the barrel; however, it may be remote from the barrel and connected thereto by suitable lead wires. An electrically operated gas release valve may be used in place of the diaphragm if it is capable of instantaneous release of a large volume of gas from chamber **22** into the barrel. Further, the control of the pressure may be performed by an electrical control device which automatically actuates a solenoid when the desired pressure in cylinder **116** has been reached after the launching device has been properly positioned and the ball placed in front of the barrel.

While only one embodiment and several modifications of that embodiment of the present golf ball testing and demonstrating apparatus have been described in detail herein, various changes and modifications may be made without departing from the scope of the invention.

I claim:

1. A golf ball testing and demonstrating apparatus comprising a barrel having breech and muzzle ends, a projectile disposed in said barrel and having a forwardly positioned face for striking a golf ball, a means defining a gas chamber connected to the breech end of the barrel, a means for supporting a golf ball in line with the barrel at the muzzle end thereof, a means for retaining gas in said chamber, and a means for piercing said gas retaining means for instantaneously releasing gas from said chamber for propelling said projectile through said barrel to cause said face to strike and drive golf ball positioned on said ball supporting means.

2. A golf ball testing and demonstrating apparatus as defined in claim **1** in which said gas chamber means consists of an elongated cylinder axially aligned with said barrel and connected to a source of gas under pressure.

3. A golf ball testing and demonstrating apparatus as defined in claim **1** in which said means for retaining gas in said chamber consists of a diaphragm disposed between the breech end of said barrel and said chamber.

4. A golf ball testing and demonstrating apparatus as defined in claim **3** in which said means for piercing said gas retaining means includes a shaft having a point thereon for rupturing said diaphragm to release the gas in the chamber instantaneously and a means for thrusting said point into and through said diaphragm.

5. A golf ball testing and demonstrating apparatus as defined in claim **4** which said means for thrusting the

shaft into and through said diaphragm consists of a spring, and a trigger means retains said shaft in a retracted position and said spring in a compressed condition until the gas is to be released from said chamber.

6. A golf ball testing and demonstrating apparatus as defined in claim **4** in which said means for thrusting the shaft into and through said diaphragm consists of a solenoid.

7. A golf ball testing and demonstrating apparatus as defined in claim **2** in which said means for retaining gas in said cylinder consists of a diaphragm disposed between the breech end of said barrel and said chamber.

8. A golf ball testing and demonstrating apparatus as defined in claim **7** in which said means for piercing said gas retaining means includes a shaft having a point thereon for rupturing said diaphragm to release the gas in the chamber instantaneously and a means for thrusting said point into and through said diaphragm.

9. A golf ball testing and demonstrating apparatus as defined in claim **1** in which said projectile consists of a cylindrical body with said forwardly positioned face disposed thereon, and is a diameter substantially the same as the diameter of the bore of the barrel.

10. A golf ball testing and demonstrating apparatus as defined in claim **1** which includes a gage means for obtaining a pre-determined pressure at which said piercing means will be operated to puncture said diaphragm.

11. A golf ball testing and demonstrating apparatus as defined in claim **1** in which said barrel is mounted on a frame and is adjustable to various angular positions to obtain variations in the flight condition of the ball.

12. A golf ball testing and demonstrating apparatus comprising an elongated cylindrical barrel, a cylinder having a gas chamber and being secured to said barrel and in alignment therewith, a metal diaphragm disposed between said barrel and said gas cylinder, a projectile disposed in said barrel and having a face for striking a golf ball, a means for preventing relative rotation between said projectile and said barrel, a means for positioning a golf ball at the muzzle end of said barrel, a frame supporting said barrel, a means for angularly adjusting the position of said barrel vertically and horizontally, a means for rotating the barrel and the projectile together to various angular positions, and a means for piercing said diaphragm and instantaneously releasing the gas in said chamber to propel the projectile through the barrel and against a golf ball positioned at the muzzle end of said barrel.

13. A golf ball testing and demonstrating apparatus as defined in claim **12** having a means defining a conduit connecting said chamber with a source of gas under pressure and a trigger for operating said diaphragm piercing means.

14. In a golf ball launching device: a barrel having a breech end and a muzzle end, a projectile disposed in said barrel and having a forwardly positioned face for striking a golf ball, a means for supporting a golf ball in line with the barrel at the muzzle end thereof, and a means for propelling said projectile through the barrel to cause said face to strike and drive a golf ball positioned on said supporting means.

15. A golf ball launching device as defined in claim **14** in which the face on said projectile may be of various angles, and a means is provided to prevent relative rotation of said projectile with respect to said barrel.

16. A golf ball launching device as defined in claim **14** in which a means is connected to the breech end of said barrel for providing a pressurized gas behind said projectile for propelling said projectile through the barrel.

17. A golf ball launching device as defined in claim **16** in which said means providing the pressurized gas includes a chamber for compressed air, and in which a means is included for instantaneously connecting the breech end of said barrel with said chamber to release the gas and propel said projectile.

* * * * *