Nov. 1, 1938. J. R. FARRAR 2,135,210

GOLF BALL

Filed March 13, 1937

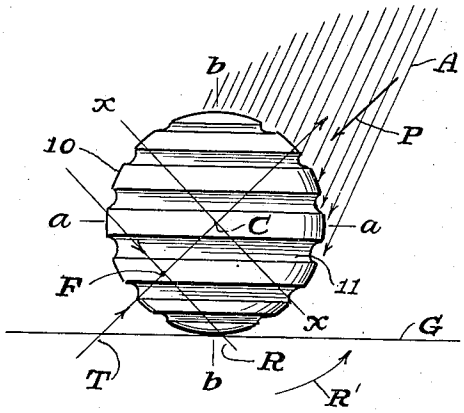


Fig. 1.

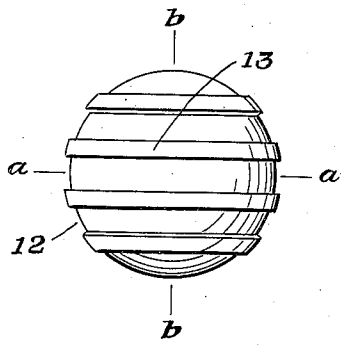


Fig. 2

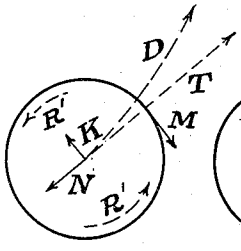


Fig. 4.

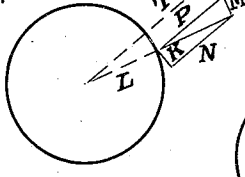


Fig. 5.

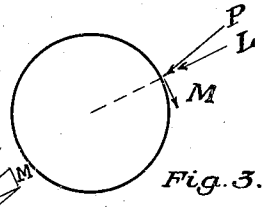


Fig. 3.

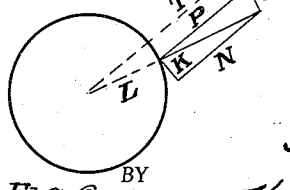


Fig 6.

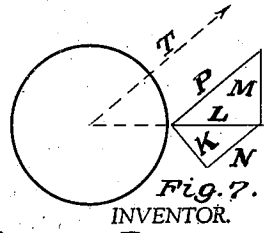


Fig. 7.

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GOLF BALL

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3 Claims. (Cl. 273—62)

This invention relates to improvements in golf balls.

It is known that if a smooth surfaced ball such as a golf ball in flight has, in addition to its movement of translation, a rotative movement the ball will have a tendency to curve; the direction and magnitude of the curve of the ball in flight depending upon the axis of the rotative movement and the direction and speed of its rotation about said axis. Experience has demonstrated that smooth surfaced balls and balls with roughened surfaces display different tendencies with respect to curving in flight, that is, the tendency of a ball in flight to curve from a straight path is dependent in part upon the surface characteristics of the ball.

An object of the invention is to provide a golf ball having its surface so formed that the tendency of the ball to curve from a straight path in flight can be in part regulated by the position in which the ball is placed prior to applying the striking force thereto.

Many golf players exhibit a marked inclination in driving a golf ball to cause the ball to curve toward the right or left from a straight path of flight. Also, some players customarily drive a ball so that it has either too much or too little elevation in flight.

Another object of the invention is to provide a golf ball which is so constructed that a player can, by positioning the ball in predetermined ways before striking the same, control or modify in part at least the flight characteristics of the ball and thereby improve his game.

Other and additional objects and advantages residing in the invention will appear hereinafter during the detailed description thereof which is to follow. Referring to the accompanying drawing illustrating the invention embodied in golf balls in several different ways,

Fig. 1 is an elevational view of a golf ball embodying one form of the invention,

Fig. 2 is a view similar to Fig. 1, but illustrating a different form of the invention, and

Figs. 3 to 7 are diagrammatic views illustrating the manner in which the various influences act on the balls in flight.

The golf ball 10 shown in Fig. 1 has formed therein a plurality of circular grooves 11 extending completely around the ball with all of the grooves parallel to each other and to the axis *a—a*. In Fig. 2 the ball 12 is provided with a plurality of raised circular ribs 13 which are parallel to each other and to the axis *a—a* and pass completely around the ball.

The purpose of the continuous circular grooves 11 and ribs 13 is to provide the balls 10 and 12 with a plurality of parallel air-resisting surfaces, all of which extend in the same direction around the balls, that is, parallel to the axes *a—a* and perpendicular and concentric to the axes *b—b*. It will be clear that if the balls rotate in flight about the axes *b—b* these air resisting surfaces just referred to will not be as effective as they would be if the balls were rotating about the axes *a—a* that are parallel to said surfaces. The effectiveness of these surfaces increases or diminishes as the angle between the actual axis of rotation of the balls and the axes *b—b* varies, as will later become more clearly evident.

It will be understood that the number of grooves or ribs can be varied as desired, and also that the depth and height of the grooves or ribs have been exaggerated in the drawing for purposes of clearer illustration.

The manner in which the air resisting surfaces of the balls function during flight, to modify the tendency of the balls to curve from a straight path, will now be described by means of a theoretical explanation which, according to my present understanding, I now believe to be the correct one.

When a ball is struck the applied striking force resolves into two component forces, one of which passes through the center of the ball and produces its translatory movement and the other of which is perpendicular to the first one and produces only rotative movement of the ball. If a ball such as the ball shown in Fig. 1, by way of example, is struck on its surface exactly at the intersection of the planes of the axes *a—a* and *b—b*, that is at the point C, the applied force will not resolve into component forces and only a translatory movement will be given to the ball. However, if the applied force is located above or below the axis *a—a* a rotative force, in addition to the translatory force, will act on the ball and tend to rotate the same about the axis *a—a*. Similarly, if the applied force is to the right or left of the axis *b—b*, the ball will be subject to a rotative force tending to rotate the same about the axis *b—b*. The two rotative forces just referred to when the applied force is both above or below the axis *a—a* and to the right or the left of the axis *b—b*, will function to rotate the ball about an axis disposed at an acute angle to both the axes *a—a* and *b—b*, as will later be pointed out.

Assuming that the ball 10 is resting on a surface indicated by the line G and is struck at the

point F by force acting perpendicularly to the plane of the view of Fig. 1, the striking force will be resolved into the force T passing through the center of the ball and representing the translatory force of the blow and into the force R that does not pass through the center of the ball and represents the rotative force of the blow acting about the axis *x*—*x* which lies in the plane of the view and is disposed at acute angles to both axis *a*—*a* and axis *b*—*b*. These are the forces acting on the ball at the instant that its flight commences. Once the ball is in flight the only forces acting thereon are the forces of gravity and air resistance. The force of gravity for the purposes of this description can be ignored.

The air resistance force is represented in Fig. 1 by the series of arrows A acting on the ball downwardly toward the left. There will be substantially no air resistance force acting on the rear side of the ball as that side is in a comparative vacuum. Since the ball is rotating in the direction indicated by the arrow R' about the axis *x*—*x*, the lower side of the ball is moving faster against the air resistance force than is the upper side, from which it can be assumed that the forces on the lower side of the ball are greater than on the upper side, and this differential in forces is indicated by the variation in the length of the arrows A. The resultant of these forces is a force acting below the line of translation T but parallel thereto, as indicated by the heavy arrow P.

In order to illustrate more clearly the manner in which the various influences act on the ball in its flight, reference will now be had to the diagrammatic illustrations of Figs. 3 to 7 inclusive.

Referring to Fig. 3, the resultant air pressure previously discussed is indicated by the arrow P, and this force can be resolved into the components L and M, the force L passing through the center of the ball and effecting its translation and the force M effecting the rotation of the ball.

In Fig. 4 the force L is resolved into the component forces N and K. An analysis of the conditions represented in Fig. 4 will give us the effects of the influences previously referred to upon the flight of the ball. As previously stated, the arrow T represents the line of translation, the arrow R' the direction of rotation, while the arrows N, K and M represent the various forces acting on the ball, and are respectively the force N, which retards translation, the force M retarding rotation and the force K pushing the ball off its original line of translation T and causing it to curve as indicated by the curved arrow D.

We may now consider the difference in the trajectory of a smooth ball and a rough ball. In this connection a ball that has its surface formed or marked so as to provide air resisting surfaces thereon is considered as a rough ball, and we may further designate these air resisting surfaces for the present discussion and to fit in with the analogy which is now to be drawn, as small paddles on the surface of the ball. Assuming two wheels of the same outside diameter, thickness, weight and moment of inertia spinning in air on an axis of the same coefficient of friction and at the same speed, with one of the wheels smooth and the other provided with paddles, it is evident that the wheel provided with paddles would slow down quicker in the air than the smooth wheel. From this analogy it can be concluded that a ball provided with paddles (a roughened surface) spinning in air will have its rotation slowed down much faster than a smooth ball and that an increase in the area of the paddles will act to increase the slowing down of the ball within certain limits.

For the purposes of this discussion we shall designate the effect of the paddles on the ball as the paddle coefficient PC. Now if the paddle coefficient is increased the vector M in Fig. 4 will be increased, but this increase of the vector M cannot be accomplished without either increasing the other factors or changing the position of the original vector P.

Fig. 5 is a graphic resolution of P into its components and shows the relative magnitude of the forces but without regard to their point of application. As previously stated, P represents the resultant air pressure on the ball, while M represents the rotating effect of the air and is proportioned to the paddle coefficient PC. The force retarding translation of the ball is represented by N, while K measures the force that creates the tendency of the ball to curve. The component L in this instance can be disregarded.

In Fig. 6 the vector M has been increased and it will be noted that all other vectors are proportionately increased, wherefore it will be seen that if an increase in the paddle coefficient PC does not change the position of the resultant air pressure, then the translation is retarded more rapidly and the force K causing the ball to curve is increased, with a resultant increase in the curvature of the flight of the ball.

In Fig. 7 the same magnitude of the force P has been shown as in Fig. 5, but its location has been lowered. Comparison of the length of the vectors in Fig. 7 with those in Fig. 6 gives the following conclusion: If an increase in the paddle coefficient does not change the resultant air pressure in magnitude but lowers its location, then the curve is increased and the translation is retarded less. By means of the analysis of the flight of the ball as set forth herein, I draw the following conclusion, namely, that in increasing the paddle coefficient of the ball, the tendency of the ball to curve is increased. By means of this conclusion I have determined that an increase in the effectiveness of the air resisting surfaces of a ball, such as the marking on a golf ball (which marks act as paddles) results in an increase in the tendency of the ball to curve. Applying this knowledge in a practical manner to a ball I have found that a ball can be so marked as to present different amounts of paddle effects, i. e., different amounts of air resisting surfaces about different axes, wherefore the ball may be placed in a predetermined position before striking so as to vary its normal curve.

The air resisting surfaces provided by the grooves or ribs in the balls illustrated in Figs. 1 and 2 are all arranged parallel with the axes *a*—*a* and concentric to the axes *b*—*b*. It will be seen that when the balls are rotating about the axes *b*—*b* or about axes closely approximating the axes *b*—*b*, the effective area of the wind resisting surfaces, that is, the effective paddle area thereof, is reduced to a minimum and closely approaches zero with a consequent reduction in the tendency of the ball to curve to the right or left from a straight path of flight.

When the balls are rotating about axes *a*—*a* or axes approximating the axes *a*—*a* the effective area of the air resisting surfaces is maximum, and hence the rotation of the balls about such axes will result in increasing the tendency of the balls to curve in flight, either upwardly or downwardly, depending upon the direction of rotation of the balls about the axes, that is, if the balls 10 were

struck below the axes *a—a* a rotative movement would be imparted to the balls about said axes and in a direction such that the tendency of the balls to curve upwardly would be increased, thus effecting a higher elevation in the flight of the balls.

A golf player who had a tendency to habitually drive the ball so that it curved to the right or to the left, would when using a ball embodying the present invention, place the same on the ground with the grooves or ribs extending horizontally to the ground. Hence when he drove the ball he would get a minimum air resisting or paddle effect from the markings thereon, with a consequent reduction in the ball's tendency to curve. A player who constantly failed to obtain sufficient elevation in his drives would place the ball also with the grooves or ribs horizontal to the supporting surface before driving the ball. On the other hand, one who obtained too much elevation in the flight of the ball, and hence a reduction in the distance of the drive, would place the ball, before striking the same, with the grooves or ribs substantially vertical to the supporting surface to thus reduce the effective paddle area and the tendency of the ball to curve upwardly. It is realized, of course, that the flight characteristics of the ball could not be controlled in toto by the markings on the ball, since such characteristics are, to a large extent, variable in accordance with the manner in which the ball is struck and it is impossible to always strike a ball in exactly the same way. However, a golf player using a golf ball embodying the present invention could effect a modification in his normal tendency to cause the ball to curve when driving the same, and, therefore, the use of the ball could be so carried out as to compensate at least partially for the player's habitual inclination to get a curving drive. In addition to overcoming the habitual tendency to drive curved balls, a ball embodying the invention could be used by players under certain circumstances to increase the tendency of the ball to curve from a straight path.

Irrespective of the reasons for desiring the different flight characteristics of the ball, it will be seen that the use of a ball embodying the present invention enables at least a limited control of its flight characteristics by the mere adjustment of the position of the ball before striking the same. The ordinary golf ball is provided with markings on its entire surface and which extend thereon in different directions, and hence it is impossible to change the effectiveness of the air resisting surfaces of the markings on the conventional golf ball.

Although two preferred embodiments of the invention have been illustrated and described herein, it should be understood that the invention is susceptible of various modifications and adaptations within the scope of the appended claims.

Having thus described my invention, I claim:

1. A golf ball having surface markings substantially solely in the form of alternate parallel ribs and grooves extending continuously around the ball and having their boundaries defined by true circles, the centers of which all lie on a common axis of the ball, wherefore when the ball is spinning about said axis the air resistance to the rotation of the ball will be substantially the same as in a smooth or unmarked ball.

2. A golf ball having surface markings substantially solely in the form of a plurality of parallel grooves extending continuously around the ball and having their boundaries defined by true circles, the centers of which all lie on a common axis of the ball, wherefore when the ball is spinning about said axis the air resistance to the rotation of the ball will be substantially the same as in a smooth or unmarked ball.

3. A golf ball having surface markings solely in the form of a plurality of parallel raised ribs formed thereon and extending continuously around the ball and having their boundaries defined by true circles, the centers of which all lie on a common axis of the ball, wherefore when the ball is spinning about said axis the air resistance to the rotation of the ball will be substantially the same as in a smooth or unmarked ball.

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