Nov. 25, 1958 F. VEATCH 2,861,810

GOLF BALL

Filed Dec. 10, 1954

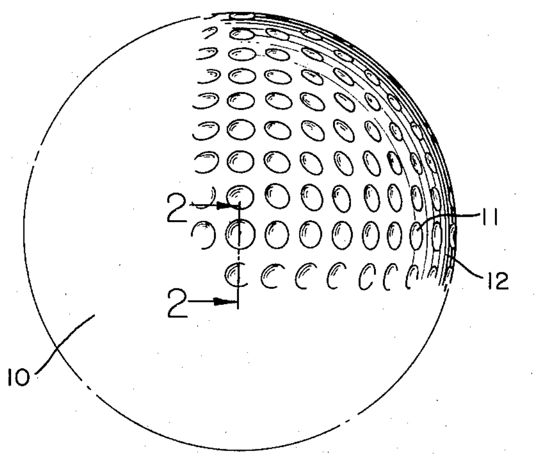

FIG. 1

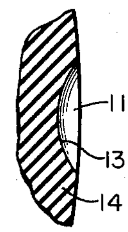

FIG. 2

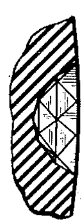

FIG. 3

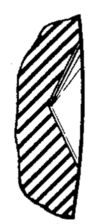

FIG. 5

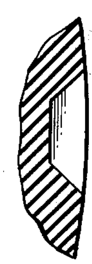

FIG. 7

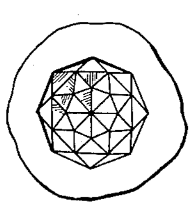

FIG. 4

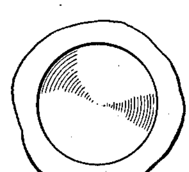

FIG. 6

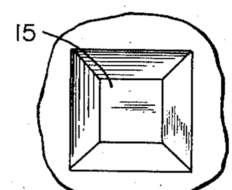

FIG. 8

INVENTOR.
FRANKLIN VEATCH

BY Lawrence E Turnock[?]

ATTORNEY

2,861,810

GOLF BALL

Franklin Veatch, Lyndhurst, Ohio

Application December 10, 1954, Serial No. 474,431

2 Claims. (Cl. 273—213)

The present invention relates to an improved golf ball, and more particularly to a golf ball possessing high light-reflecting characteristics. It also relates to methods for producing this improved golf ball.

The problems of finding lost golf balls and of following the flight of golf balls in the air have plagued golf players for years. Many methods of overcoming these problems by changing the ball have been suggested. For example, depressions in the ball's cover have been filled with luminescent material whereby the ball can be located at night or in dark places. Means associated with the ball for emitting a sound or visible vapor have been tried. All of these methods have proven to be more or less impractical.

It is an object of the present invention to provide a highly reflective golf ball whereby it may be spotted more readily on the ground or as it travels in the air. Another object is to provide such a ball whose reflectivity will not be affected appreciably under repeated impacts.

These and other objects are attained by my invention which consists of a golf ball having in its outer surface a plurality of depressions which are coated with a mirror-like metallic film not over about 0.0001 inch thick.

The invention will be better understood in connection with the accompanying drawings in which:

Figure 1 is a front elevation of a conventional golf ball;

Figure 2 is an enlarged view of a depression in a golf ball taken on the plane indicated by the line 2—2;

Figures 3 and 4 are section and plane views, respectively, of a depression shaped as a polyhedron;

Figures 5 and 6 are section and plane views, respectively, of a conical shaped depression; and

Figures 7 and 8 are section and plane views, respectively, of a depression shaped as a frustum of a pyramid.

Golf balls generally consist of a core of some suitable elastic material and a continuous tough cover, usually made of balata. The covers are shaped by molds under heat and pressure. The outer surface of the cover is punctuated by a plurality of recesses, dimples, or depressions, hereinafter called depressions. For example, a golf ball 1 $1\frac{11}{16}$ inches in diameter may have 150 depressions, each having a diameter of $\frac{1}{8}$ inch and the general shape of a spherical segment.

The invention is not limited by the actual metal used for the metallic film. Those metals which can be used include aluminum, platinum, tungsten, tantalum, molybdenum, nickel, chromium, silver, copper, and gold. Alloys of these metals may also be used. In selecting a metal for use in the present invention, such factors as its cost, the ease and cost of deposition, its film adherence and strength, and its tendency to tarnish should be considered.

The thickness of the metallic film is important. It has been discovered that metallic films not exceeding about 0.0001 inch possess sufficient flexibility to conform, without fracturing, to the contour of golf ball covers as these covers are distorted upon contact with a golf club. For practical purposes, the films need not exceed about 0.00001 inch. Although a film of any thickness will improve the light reflectivity of a surface, metallic films on the order of about 0.000002 inch will adequately conceal the color of any coated surface. Therefore, film thicknesses in the range of about 2 to 10 millionths of an inch are preferred.

There are four methods of depositing metallic coatings, namely by (1) electroplating, (2) chemical precipitation, (3) electrostatic spraying, and (4) vacuum metallizing. Although all four methods can be used in the present invention, vacuum metallizing, chemical precipitation and electroplating are preferred because of their lower cost, their capability of producing smoother films, and their ease of control. Electrostatic spraying tends to give a film which is not only too rough but also too thick.

In using the metallizing techniques, the surface of the golf ball is thoroughly cleaned and degreased with a suitable solvent to assure strong and uniform adherence of the metallic film. Although the metallic film may be deposited on this cleaned surface, an undercoat of lacquer, white paint, or the like, applied by dipping or spraying, provides a smooth, shiny, and flawless surface. Such a surface when metallized will be more reflective because the metal film precisely follows the pattern of the surface it covers. Thus, surface defects in the form of tiny cracks, scratches, and other visible blemishes are removed by the lacquer undercoat. Of course, buffing or other means for obtaining smooth undercoat surfaces may be employed.

In utilizing the vacuum metallizing process, golf balls, whose surfaces have been prepared as mentioned above, are suspended in a chamber from which air is evacuated until the pressure is on the order of $\frac{1}{2}$ micron of mercury or lower. The metal to be deposited (such as aluminum or silver) is then heated until it vaporizes; the vapors thereafter are deposited (i. e., condensed) on all surfaces exposed in the chamber, including the balls. Since the metallic films thereby produced are comparatively soft and easily abraded, the metal films on the elevated surfaces of the balls, that is, on all surfaces except those forming the depressions, may be removed by tumbling the balls in the presence of a fine scouring material or by a buffing operation. Thereafter, the balls, whose depressions are still coated with metal, are covered with a final coat of lacquer to prevent tarnishing of the metallic films.

The step which involves removing the metallic film by abrasion from elevated surfaces on the ball may be avoided by suitably masking these surfaces before or after the ball is subjected to vacuum metallizing. For example, the ball may be suspended in a tight fitting spherical container which has a plurality of perforations adapted to expose only the depressions of the ball. A technique which eliminates the necessity of removing part of the deposited metal film involves metallizing the entire surface of the ball, spraying the ball with a transparent lacquer (selected for its high abrasion resistance and adhesion to the metallic film), drying the lacquer, and then coating the elevated portions with a suitable white enamel.

In the chemical precipitating method, the golf ball, after suitable surface preparation as disclosed above, is totally covered with a mirror-like metallic film of silver by the well known two-spray-nozzle technique. One of the nozzles supplies a dilute solution of a salt of silver, and the other nozzle supplies a liquid agent which will reduce the silver and cause it to precipitate. Many compounds may be used as the essential silver reducing agent, such as sucrose, Rochelle salts, hydrazine, formaldehyde, glyoxal, pyruvic aldehyde, sodium bisulfite, pyrogallol, phenylene diamine, and others. Different silver solutions may be used, but they are commonly dilute ammoniacal solutions of silver nitrate. As a typical example, one might use dilute glyoxal as the reducing solution and a dilute silver-ammonia-nitrate complex as the silver solution. Preferably, the thickness of this film should be kept at or near the minimum required because, as the thickness of a chemically precipitated film increases, the film will become powdery and crystalline in appearance, thereby losing its mirror-like effect. After the metallic film has been chemically deposited, the film is removed from the elevated portions of the ball leaving only the depressions mirrorized. Finally, the ball is covered with a protective coating of lacquer.

The deposition of a thin metallic film on a ball by electroplating should be preceded not only by a thorough cleaning of the ball's surface but also by a pretreatment of the ball's cleaned surface to render it electrically conductive. Usually this pretreatment consists of chemically precipitating a film of silver of a thickness less than that required for a mirror-like surface. Thereafter, a film of silver, chromium, rhodium, nickel, copper, or other suitable metals may be electrodeposited to the desired thickness. Finally, excess film may be removed and the ball lacquered as described above.

Although the methods of depositing thin mirror-like films of metal are well known, it is surprising that these methods can be used to mirrorize golf balls with a metallic film flexible enough to conform to a golf ball's balata cover as that cover is violently and instantaneously distorted without the film cracking or losing any appreciable amount of its brilliance.

The shape of the depressions in the golf ball can have an important effect on the ability of a player to follow its flight through the air or to locate it on the ground. Primarily, the player only sees the ball by means of light from the sun which is reflected to him by the surface of the ball. Obviously the ability of the player to detect the ball increases as the amount of light reflected from the ball to his eye increases. This amount of light is affected by the reflectivity, size, and shape of the ball's surface. High reflectivity is obtained by means of the mirror-like metallic film. Further improvement lay in choosing the optimum size and shape for the reflecting surface.

Possible surface shapes may be characterized as plane, convex, and concave. A mirrored surface which is plane will reflect parallel light rays from a distant object, such as the sun, as parallel rays whereby the distant object will appear the same size to an observer as if he viewed the object directly.

A mirrored surface which is convex will reflect parallel light rays as divergent rays, and a mirror image of any given object will decrease in size as the observer's distance from the mirror increases. Therefore, as a given mirrored surface becomes more convex, less light reflected from it will reach a distant observer. However, this reduced brilliance is offset by the increased chances that an observer will see the ball because the light, being divergent, will be projected on a larger area.

Concave mirrored surfaces reflect parallel light rays as converging rays. The focal point for converging rays from a true parabolic surface is at a distance (focal distance) from the surface equal to about one half the radius of curvature. An observer between the focal point and the concave surface sees an enlarged image which will become infinite in size at the focal point of a parabolic surface. At distances beyond the focal point the image is inverted and decreases in size because the light rays therebeyond begin to diverge. For maximum brilliance, therefore, the golf ball should have a plurality of spots whose surfaces are concave and whose radii of curvature are such that an observer (the golf player) is at a focal point. Under average conditions a golf player would want to see a golf ball within five yards, if the ball is lost, and up to 250 yards on long tee shots. On this basis, mirrored spots on the ball should have concave surfaces with radii of curvature varying between 10 and 500 yards.

In view of the foregoing discussion, it will be seen that both convex and concave surfaces possess advantages provided their respective radii of curvature are large, that is, exceed about 30 feet.

When considering mirrored depressions in the present invention with diameters on the order of ⅛ inch, it is readily apparent that, whether the depression surfaces are either concave or convex with radii of curvature exceeding 10 yards, they may be considered as plane surfaces. Such curvatures could only be measured with sensitive optical instruments. With a mirror support as flexible as the balata cover of a golf ball, it would be practically impossible either to manufacture or maintain precise and small differences of curvature from a plane surface. As best, one could design molds to produce plane surfaces and accept the minor convexities or concavities which will inevitably occur.

In order that the quantum of light reflected will be appreciable, it is believed that the mirrored surfaces should have an area of at least 0.001 square inch, and preferably about 0.01 square inch. Except for the size of the depressions, there are no limitations on the maximum size.

The shape or design of the depressions can promote the utility of the present invention. Possible shapes include a segment of a sphere, cone, a pyramid, frustums of a cone or pyramid, a cylinder, and a polyhedron. Figure 1 shows a conventional golf ball **10** with a plurality of depressions **11** and corresponding elevated portions **12**. Figure 2 shows an enlarged cross-sectional view of a depression **11** whose surface **13** may be viewed as enclosing a space having the shape of a segment of a sphere. The depression **11** consists of a recess or dimple in the golf ball's balata cover **14**. Figures 3 and 4, respectively, disclose a side and front view of a depression shaped as a polyhedron. As mentioned above, each of its individual faces should preferably have an area of at least 0.001 square inch.

Figures 5 and 6, respectively, show a side and front view of a cone-shaped depression. Figures 7 and 8 show similar views of a depression having the shape of a frustum of a pyramid. Where the base of this depression **15** (top of the frustum) has an area of about 0.01 square inch, the depression would have an optimum design or shape for the present invention.

While the methods and products of the present invention have been described with reference to specific embodiments, it will be apparent to those skilled in the art that various modifications may be made without departing from the principles and true nature of the invention.

I claim:

1. A golf ball having a plurality of depressions in the outer cover of said ball, each of said depressions being coated with an inner layer of a flexible, mirror-like metallic film not over about 0.0001 inch thick and an outer layer of a tough, transparent lacquer, and each of said depressions having a base of at least 0.001 square inch.

2. A golf ball having a plurality of depressions in the outer cover of said ball, each of said depressions being coated with an inner layer of a flexible, mirror-like metallic film not over about 0.0001 inch thick, and an outer layer of a tough, transparent lacquer, each of said depressions having a base of at least 0.001 square inch and said base having a radius of curvature in excess of 30 feet.

References Cited in the file of this patent

UNITED STATES PATENTS

178,466	Read	June 6, 1876

694,946	Daly	Mar. 11, 1902
1,118,878	Rafn	Nov. 24, 1914
1,329,381	Dunlap	Feb. 3, 1920
1,418,220	White	May 30, 1922
1,795,732	Miller	Mar. 10, 1931
2,063,034	Freund	Dec. 8, 1936
2,375,669	McKinney	May 8, 1945
2,474,273	Olson	June 28, 1949

FOREIGN PATENTS

2,884	Great Britain	1914
568,415	France	Dec. 21, 1923
315,575	Great Britain	July 18, 1929