Nov. 7, 1967 C. J. SMITH ETAL 3,351,347

ELECTROLUMINESCENT GAME BALL

Filed April 10, 1964

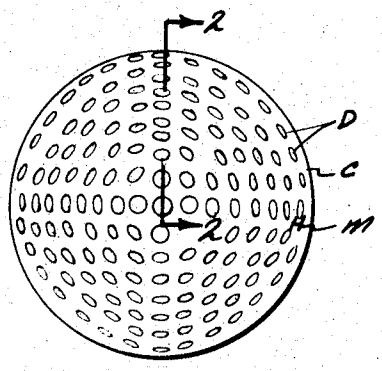


FIG-1

FIG-2

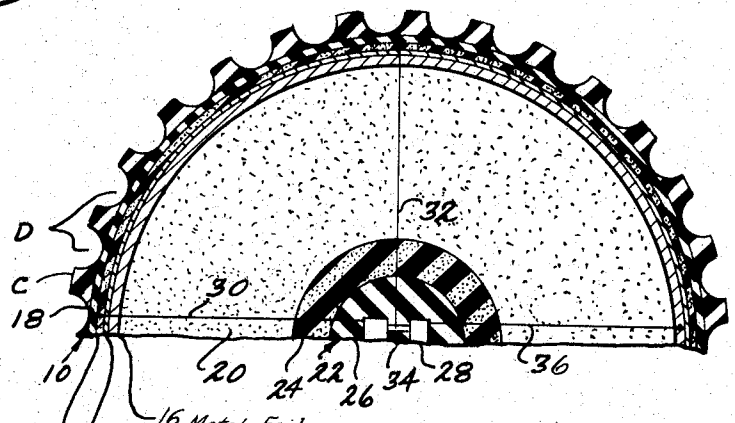


FIG-3

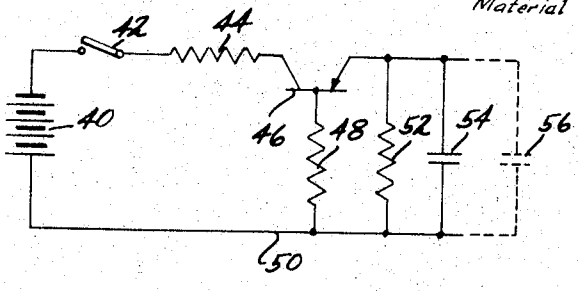
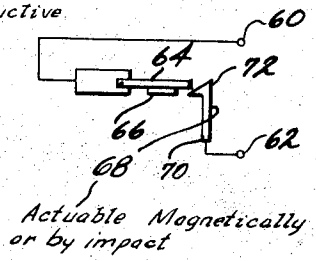


FIG-4



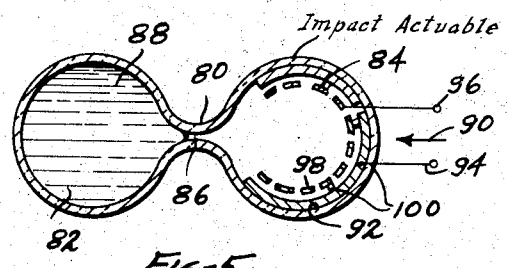


FIG-5

INVENTOR.
CHARLES J. SMITH
BY HUGH W. JAMIESON
Wilson, Robbins & Anderson
ATTORNEYS

United States Patent Office 3,351,347 Patented Nov. 7, 1967

3,351,347

ELECTROLUMINESCENT GAME BALL

Charles J. Smith, 11459 Bellagio Road, West Los Angeles, Calif. 90049, and Hugh W. Jamieson, 11522 Mulholland Drive, Los Angeles, Calif. 90024

Filed Apr. 10, 1964, Ser. No. 358,815
2 Claims. (Cl. 273—213)

The present invention relates to a ball as used in sporting activities, and particularly to such a ball that radiates light, as for night use.

Most, if not all sporting activities in which a ball is used require the player's concentration on the ball. For example, in playing golf, the player after analyzing the position of the ball, focusses his attention on it while attempting to strike it in accomplishment of a predetermined plan for the ball's movement. After the ball is hit, the player must concentrate on its flight path so as to locate it for his next stroke.

This demand for concentrated attention on the ball in sporting activities as golf has in the past meant that most such activities were confined to daylight hours when ambient light is sufficient to enable the player to clearly see the ball. Of course, some playing fields, courts and courses have been illuminated; however, usually play at such facilities involves some playing compromise and considerable expense.

Again with reference to the game of golf as an example, courses that are illuminated for night play are usually small, a characteristic necessitated by economic considerations. Furthermore, play in artificial light is ofen difficult because of the irregular light patterns. That is, often the ambient light changes so rapidly between areas, depending on the arrangement of the lights, that distances and terrain are difficult to judge, and the ball is hard to follow. Therefore, prior attempts to extend the useful period of golf courses, as well as many other types of playing fields or areas have not been completely successful. This consideration exists in spite of the fact that a great deal is to be gained by any method or means that economically and effectively extends the useful period of a golf course. Not only is any increase in the effective period of use of a golf course important, but, economically facilitating play during evening hours when darkness would otherwise render the course unusable is extremely important because, during such periods there is a vastly increased number of players who have time available for play.

In general, the present invention comprises a ball for use in sporting activities that provides radiating light, which light makes the ball readily visible in darkness and more easily followed in play. The structure of the ball includes an oscillator circuit as incorporating a semiconductor device and a battery to provide electrical oscillations, which circuit is mounted and dynamically balanced in a core of the ball. A ball body is then provided about the core and contiguous the outside cover, electroluminescent means radiates light, energized by the electrical oscillations. Various switching structures may be included in accordance with the invention for activating the oscillator circuit when the ball is ready to be used.

An object of the present invention is to provide an improved ball for economic and effective use in sporting activities during times of darkness.

Another object of the present invention is to provide an improved ball that radiates light so as to be usable in darkness.

Still another object of the present invention is to provide a playing ball, e.g. golf ball, that radiates light energy, the operation of which can be initiated from a location remote the energy means.

A further object of the present invention is to provide a playing ball that appears and responds substantially as a

regulation ball for a particular sport, however, which ball emits light for night use.

Still a further object of the present invention is to provide a ball for use in athletic activities, e.g. golf, which ball is usual in appearance and response, but contains, a means for providing electrical oscillations, an electroluminescent means energizable thereby for efficiently providing light to render the ball readily perceivable in darkness, and a switch means to initiate the electrical oscillations.

These and other objects of the present invention will become apparent to those skilled in the art from a consideration of the following, taken in conjunction with the drawing, wherein:

FIGURE 1 is a front elevation of a golf ball constructed in accordance with the present invention;

FIGURE 2 is a vertical sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is a circuit diagram of the electrical system of the ball of FIGURE 1;

FIGURE 4 is a diagrammatic representation of one form of switch for the electrical system of FIGURE 3; and

FIGURE 5 is a diagrammatic representation of another form of switch for the electrical system of FIGURE 3.

Referring initially to FIGURE 1, the invention will be described with reference to a golf ball; however, it is to be understood that various other balls for athetlic and other use can be made for effective use in accordance with the present invention by applying the teachings hereof. It is, however, usually important that the ball generally appear and respond substantially as a regulation ball for the sport it is intended. Therefore, the ball as shown in FIGURE 1 appears as a conventional golf ball, one size of which is 1 11/16" in diameter, and is covered with an array of some 150 depressions or spherical dimples D formed in a tough, continuous cover C, formed for example of balata.

In the illustrative embodiment described herein, light radiates from the ball, passing from a location inside the cover C, primarily through the dimples D. If the cover C is opaque the dimples are left open, otherwise light-transmission material may provide a thin layer over the dimples. The light is not usually intense at best, but rather is somewhat above a glow level so that the ball can be clearly viewed in good contrast to surrounding darkness or low-level natural night illumination. In this regard, the ball hereof offers a somewhat considerable advantage in use over a conventional ball on an illuminated golf course, because, natural light (or darkness) is substantially uniform over the course and intensely-bright light sources that often temporarily blind players are avoided.

The ball as shown in FIGURE 1, carries a mark M in the form of the latter H. Of course, other symbols may be employed and additional symbols may be provided; however the mark M is pertinent to the structure of the invention. Subsequent to manufacture, but before the ball is placed in use, it is important that its contained energy source be preserved. Therefore, the system that provides light within the ball is not actuated until the ball is ready to be used. In one arrangement disclosed herein, the light source is activated by providing a strong magnetic field, directed at the letter H. In another such arrangement, operation of the light source is initiated by striking the ball substantially on the spot marked by the letter H. The energy so applied to the ball closes a switch within the ball to operate the light source. Thereafter, the ball radiates light and can be effectively used for night play in darkness.

Considering the structure of the ball of FIGURE 1 in greater detail, reference will now be had to FIGURE 2. Inside the cover C, and thus contiguous the outer surface of the ball is an electroluminescent means **10**, comprising

an external layer **12**, a phosphor layer **14**, and internal layer **16**. The phosphor layer **14** may comprise various electroluminescent materials, as well known in the prior art, disposed in electrically insulating relationship between the electrically-conductive layers **12** and **16**. The layer **16**, may for example be a metallic foil, e.g. aluminum, while the layer **12** may be conductive light-transmitting plastic, as well-known in the prior art relating to electroluminescence.

The electroluminescent means **10**, comprising the three spherical layers **12**, **14** and **16** lies between a protective coating **18** and a resiliently-deformable ball body **20** that may take the form of an elastic wrap. The protective coating **18** may comprise various light transmissive materials, e.g. plastic, rubber, etc. which affords protection for the electroluminescent means **10**. Regarding the coating **18** and the layers **12**, **14** and **16**, the sizes shown in FIGURE 1, are merely illustrative and not indicative of actual sizes. Actually, the total thickness of the electroluminescent means **10** may in one form be only $\frac{1}{32}$"; however, other thicknesses can also be successfully used.

Inside the resiliently-deformable body **20** is the core **22** comprising a shell **24** of medium hard rubber for example, encasing a ball center **26** which houses a source **28** of electrical oscillations. The center **26** may consist of various materials, including hard plastic having a specific gravity near the equivalent specific gravity of the elements in the source **28**. That is, the center **26** is dynamically balanced, just as is the entire ball, and careful selection of the material in the center **26** facilitates such balancing.

The components of the source **28** of electrical oscillations are described below in detail; however, in function, the source provides electrical energy by which the electroluminescent means **10** produces light. The conductors for providing the electrical energy to the means **10** extend in each of six directions in space quadrature, and in FIGURE 2, conductors **30**, **32**, **34**, and **36** are shown. Thus, the conductors tend to balance. Each pair of opposed conductors, e.g. conductors **30** and **36**, provide oscillations across the electroluminescent means **10**. That is, for example, the conductor **30** is connected to the layer **12** while the conductor **36** is connected to the layer **16**, so that oscillations are applied across the phosphor layer **14** causing it to provide light by electroluminescence.

The electrical character of the electroluminescent means **10** is similar to a capacitor and when the insulating phosphor is accordingly subjected to an oscillating electrical field, it produces visible light. The light so produced passes from the phosphor layer **14**, through the layer **12**, the coating **18** and the dimples to provide light from the ball. The light provided from the ball may be of various intensities for various applications, and can be adjusted by varying the frequency of the oscillations. In one system 500 cycles per second has been found satisfactory.

The source **28** of oscillations may take the form of a battery adapted to drive a semiconductor oscillator. Specifically in FIGURE 3, a battery **40** has a negative terminal connected through a switch **42** and a resistor **44** to the collector electrode of a transistor **46**. The base electrode of the transistor **46** is connected through a resistor **48** to a conductor **50** that is connected to the positive terminal of the battery **40**. The emitter electrode of the transistor **46** is connected through a parallel combination back to the conductor **50**. The parallel combination includes a resistor **52**, a capacitor **54** and the electroluminescent means which appears electrically as the capacitor **56**.

In the operation of the system, the capacitors **54** and **56** are charged and discharged through the transistor **46** in accordance with well-known emitter-controlled pulse oscillator operation. In effect, the emitter current varies in accordance with the capacittive charge to accomplish oscillations. Usually, the capacitor **54** will be provided to supplement the characteristic capacitance of the electroluminescent means; however, it is to be understood that the capacitance of the electroluminescent means may be effectively used in the source of electrical oscillations as a capacitance while being energized to produce light.

In the use of the ball as disclosed herein, it is normally desirable to preserve the system inoperative pending the time when the ball is to be used. Therefore a long life battery, e.g. dry cell or cadmium unit, may be used, with the switch **42** being operated just prior to the period of use. Of course, a needle hole or other access opening may be provided in the ball to operate the switch; however, it is desirable to have the ball appear regulation, in which case no hole would appear. Therefore, the switch **42** as provided in the ball disclosed herein is adapted for operation by energy applied at the exterior of the ball as will now be considered.

Referring to FIGURE 4, there are shown a pair of terminals **60** and **62**, representing the ends of a simple "on-off" switch. The terminal **60** is connected to a pivotally-mounted leaf contact **64** carrying a weight **66**, made for example of steel. Perpendicular the contact **64** is a latch spring **68**, resilient in nature and anchored at the lower end **70**, which spring is connected to the terminal **62**. The upper end of the spring **68** is formed into a latch hook **72**.

In the operation of the switch of FIGURE 4, energy is applied to the ball containing the switch to push the contact **64** down latching it under the hook **72** and closing the circuit between the terminals **60** and **62**. The applied energy may take the form of a magnetic field acting on the weight **66** applied in accordance with the external ball marking M, to pull the contact **64** down. Alternatively, the ball may be struck so that acceleration forces applied to the weight **66** accomplishes the desired latch up.

Often the ball will be used during a continuous interval of sufficient time to consume the light-producing stored energy. However, in some instances it may be desirable to open the switch and various techniques can be employed. For example, the spring **68** may be formed of magnetic material so as to be moved to release the contact **64** upon application of a strong magnetic field in space quadrature with that previously applied.

Another structure that may be used as the switch **42** is shown in FIGURE 5. An enclosure **80** defines adjacent cavities **82** and **84** joined by a capillary passage **86**. The cavity **82** contains a body **88** of mercury, which under normal handling of the ball will not flow through the small capillary passage **86**. However, when the ball is struck with a golf club urging it in the direction indicated by the arrow **90**, as keyed by the external mark M, a sufficient acceleration force is applied to the body **88** of mercury to force some of it through the passage **86**.

The interior of the cavity **84** carries a conductive coating **92** connected to one switch terminal **94**. Another switch terminal **96** is connected to a conductive screen **98** affixed near the coating **92** by insulation strips **100**. Upon the entry of mercury into the cavity **84**, some of it dwells between the screen **98** and the coating **92** to provide a closed circuit between the terminals **94** and **96**. As the ball is continued in normal use, sufficient mercury will remain in the cavity **84** to maintain a closed circuit between the terminals **94** and **96**.

In the manufacture of various balls incorporating the present invention, a wide variety of established techniques may be employed. However, it is usually important to provide an arrangement of the oscillator components, the battery and the switch which can be embedded in the ball center **26** so as to provide a dynamically-balanced sphere. In the manufacture of the ball disclosed herein, the center **26** is enclosed in the shell **24** and the body **20** with the electrical conductors extending therethrough. The layers **12**, **14** and **16** are next applied as well known in the electroluminescent art and the conductors are appropriately connected. Last, the protective coating **18** and the cover

C are applied to provide a ball in accordance with the present invention.

Thus, it may be seen that the structure of the present invention may be effectively embodied in a golf or other athletic ball for use at night to facilitate effective play. In this regard, it is to be noted that the use of the ball of the invention not only avoids the considerable expense of illuminating the area of play but furthermore enables play in very limited natural light (essentially darkness) without the problems attendant irregular light patterns. In this regard, play may be more natural than in artificial illumination in which attempts are made to simulate daylight.

A further feature of the present invention is the possibility of establishing a desired pattern of light on the playing ball. For example, in the embodiment of a golf ball as described herein, illumination is from the dimples, and this pattern of light may be very useful in studying the ball's movement, as on the putting green. In this regard, other types of balls may desirably provide light in various other patterns, e.g. along seam lines, or on spots etc. depending on the sport and the desired showing.

Of course, other important features of the invention will be apparent on study of the disclosed embodiment, and as pointed out above relative that illustrative form; however, it is to be understood that the invention is not to be limited to such form, but rather shall be interpreted in accordance with the following claims.

What is claimed is:

1. A ball for sport use as under conditions of restricted ambient light, comprising:

an electrical oscillator circuit, including a semiconductor device;

battery means for energizing said oscillator circuit;

a ball structure including a resiliently-deformable section, said ball structure enclosing said battery means and said oscillator circuit;

an electroluminescent means contiguous the external surface of said ball structure, said electroluminescent means being energizable by said oscillator circuit to provide light energy; and

switch means contained in said ball structure, actuable to energize said electroluminescent means from said oscillator circuit, said switch means being magnetically actuatable by energy applied exteriorly of said ball.

2. A ball for sport use as under conditions of restricted ambient light, comprising:

an electrical oscillator circuit, including a semiconductor device;

battery means for energizing said oscillator circuit;

a ball structure including a resiliently-deformable section, said ball structure enclosing said battery means and said oscillator circuit;

an electroluminescent means contiguous the external surface of said ball structure, said electroluminescent means being energizable by said oscillator circuit to provide light energy; and

switch means contained in said ball structure, actuatable to energize said electroluminescent means from said oscillator circuit, said switch means being impact actuatable by energy applied exteriorly of said ball.

References Cited

UNITED STATES PATENTS

1,622,421	2/1927	Coffield	273—213
2,714,683	8/1955	Jenkins	313—108
3,153,745	10/1964	Gurian et al.	313—108
3,229,976	1/1966	Allen	46—228 X

OTHER REFERENCES

"Radio-Electronics," June 1956, p. 79.

ANTON O. OECHSLE, *Primary Examiner.*

DELBERT B. LOWE, F. BARRY SHAY, *Examiners.*

G. J. MARLO, *Assistant Examiner.*