Golf Club Heads
Patent Landscape Study

Landon IP, Inc.
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(Sample)
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Purpose of this Document

The purpose of this document is to serve as a sample Patent Landscape Study by Landon IP, Inc. for review by prospective Landon IP, Inc. clients. It is general in nature and intended to provide readers with the type of information a Patent Landscape Study can deliver. It includes common analysis techniques familiar to most professionals. It does not, however, include analysis techniques considered proprietary at Landon IP, Inc. which can go into significantly more depth than presented here. Should you have interest in exploring a Patent Landscape Study, please contact us at (703) 486-1150 or mail@landon-ip.com.

Golf Club Head Patent Landscape

Summary of Golf Club Head Inventions 2001 - 2005

All companies involved in golf club head research participate in a type of performance "arms race" in which the goal is to give every possible advantage to players, within PGA standards, that could help those players to improve their game. Inventions revolve around making a golf ball consistently travel truer and farther for both novices and experienced players. Upon investigating golf club patents, inventions to do the following proved the most common:

1. Efficiently transfer energy from the club head to the ball with a minimum of energy lost due to vibration or unfavorable club or ball compressions
2. Optimal distribution of weight in the club head to create a preferred, typically lower, center of gravity in the club without harming the durability of the club
3. Construct the club head from multiple materials, to include titanium, stainless steel, aluminum, fiber plastic, and other composites, that optimize club strength and weight characteristics
4. Design the club head so that, even if players strike the ball in a less than optimal way, the result proves more forgiving to the user so he or she has a higher probability of making the intended shot
5. Establish methods to produce golf club heads that allow players to receive the physical benefits shown above, that also produce the right feel and sound to account for the psychological/mental aspects of player performance
Callaway Golf is a clear leader in patenting, followed by several American and Japanese companies. 19% of assignees account for 75% of occurrences, a number that is in agreement with the Pareto Rule: 20% of the members in a set tend to produce 80% of the results.

Although Callaway Golf has more than twice the number of patents displayed by its nearest rival, the overall slope of patent documents to assignees on the Pareto chart above is characteristic of a distribution seen in contested markets as opposed to dominated markets. No company, Callaway Golf or otherwise, has a lock on the inventive principles and technology used to enhance player performance with improved golf club heads.

The patents in the study showed a predominance of inventions which represent incremental improvements to existing technologies, rather than fundamental innovations. The existing state of the art, which has already tapped into advanced materials science and performance physics, will likely continue to produce primarily incremental improvements in performance over the existing art. The PGA regulates golf club head designs to ensure they fall within the accepted rules of the game and do not create unfair advantages, which also tends to keep improvements at the incremental level.

These incremental improvements, however, can make a huge difference in how a club does in the marketplace, particularly if the improvements are associated with a reputable brand. That marketing edge tends to drive research and development, even towards minor advances.
Patenting Trend

Modest increases in patent activity appear on a year to year basis regarding the total number of patent documents published from 2001 to 2005. This growth trend should continue as companies seek to offer even the slightest edge that can make it easier to market golf clubs. Most new patents show incremental improvements over previous inventions, and may include innovations that are as subtle as improved groove design on club faces that favorably affect some aspect of a golf ball’s spin, for example, to give a ball more back spin so that it does not roll as much when it lands.

*Note: The bar for 2005 on the graph above represents January through August only. 2005 is on track to exceed 2004 along the trend line established from 2001 to 2004.*
The United States appears to dominate the total number of patent documents pertaining to golf club heads. Further investigation shows that a substantial portion of the US patent documents belong to entities having fewer than three patents, and that in the more intensive areas of golf club research, five of the top inventing organizations are Japanese, and the other top five are US. Both the US and Japan are counties favorable for producing golf club research due to the popularity of the game in each country, and the high involvement of both countries in advanced materials research. US researchers in particular have made advances in materials research science thanks to aeronautical innovations. Japan, which likewise has advanced transportation sciences to include aeronautical research, also has a history and tradition of precision metal refinement. (In fact, this tradition could be said to date back hundreds of years to the precision crafted Samurai Sword.). Consistent with advances in golf clubs, both countries have strong bases of sports research in bicycles and tennis rackets that make use of advanced materials research. The US and Japan are likely to continue their lead in research on golf club heads. The 3% of patents attributed to the United Kingdom, where golf was invented, belong to inventors and organizations with one or two inventions each, and the field shows no indication of growing. China, where golf has gained a strong foothold, could become a player as its industries ramp up to the quality levels in the US and Japan, but the patent data does not show any trend in China’s activity that would affect the immediate future.
The above patent citation profile is consistent with the profile of a contested field in which most inventions are incremental improvements over previous inventions. The majority of patent citations reference other golf club inventions as opposed to inventions outside the industry.

Backward citations represent the number of patent document citations patent examiners used to assess the validity of each company’s patent applications. Forward citations represent the number of times patent examiners cited patent documents from each company’s portfolio while examining other patent applications.

With 338 citations, patent examiners have cited Callaway Golf patents considerably more than the patent documents of other companies. This is partially because of the large number of patents in the Callaway portfolio, and partially because of Callaway’s historical lead in the introduction of advanced materials into products, such as their titanium Big Bertha club introduced in 1991. The large number of citations of Callaway Golf patents is consistent with a patent document portfolio that contains state-of-the-art technology central to the field: forward citations show that the inventions are known and frequently referenced by new art.
Profile for Top 3 Patenting Companies

1. **Callaway Golf Company** is the world's largest manufacturer of golf clubs. Its intention from its published corporate goals is to provide golf club heads capable of allowing even beginners to play golf with ease. It gained prominence in the market with its oversized Big Bertha clubs that Callaway's use of titanium made possible. The company's patent profile comprises documents that describe:
   - Golf club sets with a large tolerance for error on the part of the user
   - Methods to afford favorable weight characteristics to golf club heads without harming the structural integrity of the club head
   - Adjustments to the location of the club center of gravity, typically lower in the club to improve control
   - Greater efficiency in the amount of adhesive material used to attach the golf club head to the shaft assembly
   - Methods to lower internal stresses on the club caused by golf ball impact without diminishing club performance
   - Means to provide a more efficient impact and transfer of energy to a golf ball with the golf club head


2. **Mizuno Corporation** has concentrated its research on maximizing the performance of the golf club head through advanced design and advanced materials use. As is characteristic of many Japanese companies in the field, Mizuno researchers place a strong emphasis on inventions that both succeed in their physical purpose and improve, or at least do not diminish, the psychological aspects of the club's feel to the user. The company's patent portfolio comprises documents that describe:
   - Golf club sets that diminish the variation of the distance carry and flying direction of a golf ball that accompanies user inconsistency in hitting position and placement
   - Golf club skids that prevent digging into the turf
   - A coating layer to protect a golf club head that will not rupture after repeated impacts with golf balls
   - Golf club heads that enable easier adjustment of the center of gravity position as desired without increasing the mass of the golf club head
   - Golf club heads with enhanced strike efficiency and quality made possible by improving the shapes of projections built into a manufacturing mold to form channels on the face plane of the golf club head
Golf club heads which can reduce unevenness in the flying direction or the carry of a ball, even if struck in a less than optimal fashion, that also improve the ball hitting sound.

The means to regulate the maximum noise level value of the striking sound when striking a ball, especially on a golf course or on a golf training field, to achieve both precision of striking feel and the reduction of striking sound.

Re-distribution of weight to create a consistent sweet spot location, with a deeper center of gravity, while maintaining the maximum amount of solid feel throughout the swing.

A lower, deeper center of gravity that optimizes launch angle and reduces spin for exceptional ball flight distance


3. Burrows Golf, Inc. had interest in improving the transferability of impact energy from the golf club head to the golf ball. Most of the inventive work from Burrows appears the effort of a single prolific inventor, Bruce D. Burrows, who has developed the single concept of an inverted and thin titanium dome cut into the club itself. This dome reduces vibration, keeps that otherwise lost energy inside the golf club head, and improves the transfer of that energy to the golf ball. Because of the nature of its advances, Burrows Golf has more design patents than the other entities in the field. The company’s patent portfolio comprises documents that discuss:

- Methods for reducing the transmission of vibrational energy from the club head to the associated club shaft
- Venting of the club shaft to permit and facilitate transmission of shock energy generated upon normal striking impact with a golf ball from the golf club in the form of acoustic (vibrational) energy, while eliminating transmission of the shock energy in the form of vibration to the golf club shaft and the golfer's hands
- Provision of a metal-wood type golf club head by which the transferability of impact energy to the ball, in the form of acoustic (vibrational) energy in a golf club head, is improved
- Design of a golf club head wherein an inverted titanium dome keeps energy inside the club head and improves the efficient transfer of that energy to the golf ball instead of producing vibrations that both waste energy and prove uncomfortable to the user


Top 5 Inventor Teams

- **Callaway Golf Company**
  - Evans, Clayton
  - Jacobson, Daniel R.
  - Cackett, Matthew T.
  - Rollinson, Augustin W.
  - Reyes, Herbert
  - Murphy, James M.
  - Helmstetter, Richard C.
  - Galloway, Andrew
  - Hockneil, Alan

- **Callaway Golf Company**
  - Guard, John G.
  - Dewanjee, Pijush K.
  - Hettinger, Ronald K.
  - Byrne, Wayne H.

- **Taylor Made Golf Co., Inc.**
  - Wahl, Bret
  - Anderson, David
  - Vincent, Benoit
  - Beach, Todd P.

- **Mizuno Corporation**
  - Nagao, Yasushi
  - Tsuji, Kei
  - Iwata, Mototaka
  - Nagao, Hiroshi
  - Sakai, Koji

- **The Yokohama Rubber Co., Ltd.**
  - Nakahara, Norihiko
  - Nishizawa, Yoh
Profile for 3 Inventor Teams

- Evans, Jacobson, Cackett, Rollinson, Reyes, Murphy, Helmstetter, Galloway, and Hockneil at Callaway Golf have worked on golf club heads made with titanium or steel faces of varying thickness with metal or composite aft materials. Additional innovations include a metal strip in the ribbon section of the club to provide favorable weight characteristics without affecting the structural durability and balance of the golf club head. The varying thickness of the faces allows the faces to endure the stress load of repeated impacts with a golf ball at places with a high probability of striking the ball, while not adding weight where thickness is not needed that would otherwise diminish club performance. The club head may be composed of three pieces, a face, a sole and a crown. Each of these pieces may be composed of a titanium material, stainless steel, or other suitable materials. Golf club heads seek to improve the performance of all players, to include novices.


- Wahl, Anderson, Vincent, and Beach at Taylor Made Golf Co., Inc. have worked on golf club heads that exhibit greater forgiveness to the user across a substantial portion of the striking face, even when striking the golf ball in a less than optimal fashion, while continuing to impart high initial velocity to the golf ball. Another issue the team has dealt with involves finding ways to lower the center of gravity – which tends to improve lift for less experienced users – without increasing stiffness that diminishes the feel of the clubs in the hands of the users. The inventors have also paid attention to club faces, including an innovation that increases ball backspin to decrease roll when the ball lands. Other inventions include manufacturing processes associated with producing the innovations designed for the improved golf clubs.


- Nakahara and Nishizawa at The Yokohama Rubber Co., Ltd. have worked on golf club heads that have a hollow structure and a constitution of fiber reinforced plastic, obtaining both vibration damping performance and a pleasant hitting sound by combining different materials. Their apparent objective is to design clubs optimal both for their practical performance characteristics and their psychological affect on the performance of the user. The inventors have also looked for alternative materials to titanium,
such as a specially processed aluminum, to deal with limits on possible center of gravity adjustments of the other metals, while maintaining their focus on achieving better physical performance without harming the feel of the club to the user.

Five Patent Abstracts Associated with the Study

**US6386990 B1**
Composite golf club head with integral weight strip
Callaway Golf Company
No Image Available

**Abstract:**
A golf club head composed of a composite material and having a metal weight strip in a ribbon section is disclosed herein. The metal strip may be composed of copper, tungsten or a similar metal. The composite golf club head may also have a sole plate composed of stainless steel attached to a sole of the golf club head. The golf club head is preferably composed of plies of pre-preg sheets. A method for fabricating the golf club head is also disclosed herein. The method uses a three-piece mold and bladder to produce a composite golf club head with a metal weight strip embedded in the ribbon.

**Inventor(s):**
Reyes, Herbert
Murphy, James M.
Evans, D. Clayton
Galloway, J. Andrew
Jacobson, Daniel R.

**Application No.** 09/474688, **Filed** 19991229, **Granted** 20020514
**US Class:** 473344
473345  473348
**Int'l Class:** A63B05304
**Abstract:**
A golf club having a club head with a striking plate having a thickness in the range of 0.010 to 0.250 inches is disclosed herein. The club head may be composed of three pieces, a face, a sole and a crown. Each of the pieces may be composed of a titanium material. The striking plate of the club head may have an aspect ratio less than 1.7. The striking plate may also have concentric regions of thickness with the thickness portion in the center. The club head may be composed of a titanium material, have a volume in the range of 175 cubic centimeters to 400 cubic centimeters, a weight in the range of 165 grams to 300 grams, and a string plate surface area in the range of 4.00 square inches to 7.50 square inches. The golf club head may also have a coefficient of restitution greater than 0.8 under test conditions such as the USGA test conditions specified pursuant to Rule 4-1e, Appendix II, of the Rules of Golf for 1998-1999.

**Inventor(s):**
Galloway, J. Andrew  
Helmstetter, Richard C.  
Hocknell, Alan  
Boyce, Ronald C.  
Aguinaldo, Homer E.  
Woolley, Curtis S.

**Application No.** 09/431982, **Filed** 19991101, **Granted** 20020312  
**US Class:** 473342  
473345  473349  
**Int'l Class:** A63B05304  
A63B05306  A63B05308
Abstract:
A golf club having a club head having with a coefficient of restitution greater than 0.845 and a durability to withstand 2000 impacts with a golf ball at 110 mile per hour is disclosed herein. The club head may be composed of three pieces, a face, a sole and a crown. Each of the pieces may be composed of a titanium material. The club head may be composed of a titanium material, have a volume in the range of 175 cubic centimeters to 400 cubic centimeters, a weight in the range of 165 grams to 300 grams, and a striking plate surface area in the range of 4.00 square inches to 7.50 square inches.

Inventor(s):
Galloway, J. Andrew
Helmstetter, Richard C.
Hocknell, Alan
Boyce, Ronald C.
Aguinaldo, Homer E.

Application No. 09/705253, Filed 20001102, Granted 20020521
US Class: 473345
473290  473305  473342
Int'l Class: A63B05302
A63B05304  A63B05306  A63B05308
Abstract:
A golf club head (10) of the metal wood-type is provided, wherein the sole plate (12) of the club head (10) includes a downwardly open recess (16) defined by a generally centrally located dome element (14). Internal stiffening ribs (36) may be provided within the club head to extend between the dome element (14) and a selected club head side wall, preferably such as the front or ball impact face (24) of the club head.

Inventor(s):
Burrows, Bruce D.

Application No. 09/807847, Filed 20010419, Granted 20020723
US Class: 473328
473345  473346
Int'l Class: A63B05304
PCT Publication Number: WO0027484 Date:20000518
PCT Application Number: US9823839
Abstract:
A golf club head having a sole portion which includes a first and second outside runner carried by the sole portion. The outside runners are offset from one another to define a deflection channel. A deflection element is carried within the deflection channel. The deflection element has a front and a rear and an intermediary portion which extends from the front to the rear. The intermediary portion rises from the front towards the rear to a general height. The height of the intermediary portion of the deflection element does not exceed the height of the first and second outside runners.

Inventor(s):
Nagai, Masao
Llewellyn, David

Application No. 09/759973, Filed 20010112, Granted 20020709
US Class: 473328
Int'l Class: A63B05304