

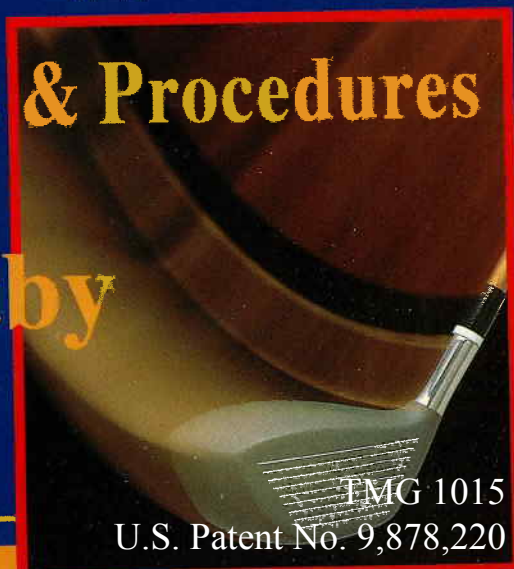


Golf Club Design, Fitting, Alteration & Repair

4th
Edition



The Principles & Procedures
Ralph Maltby



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GOLF CLUB DESIGN, FITTING, ALTERATION AND REPAIR

the principles and procedures

by Ralph Maltby

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The location of the center of gravity in the vertical plane is one of the key variables in controlling ball trajectory. See Figure 48-5. The lower the center of gravity the higher the trajectory and the higher the center of gravity the lower the trajectory. Of course, this assumes that all other variables are constants and the impact location is at the same point on the clubface.

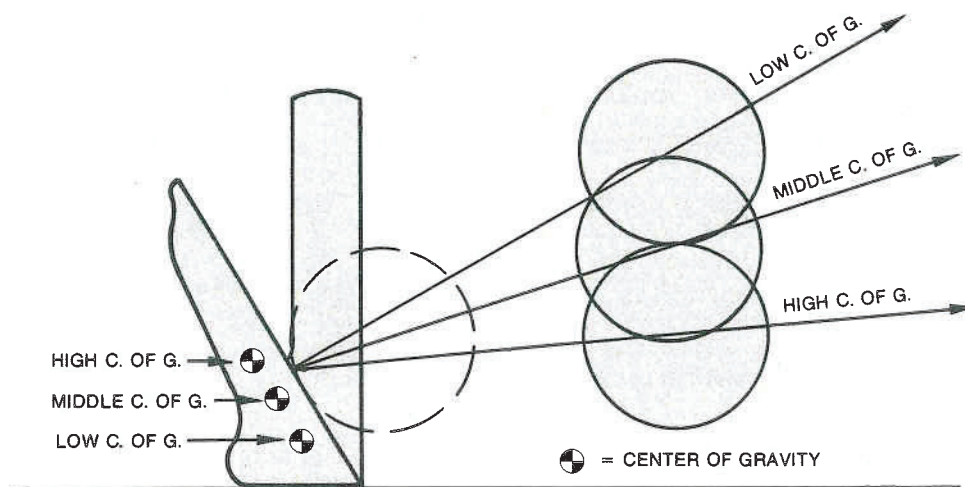


Figure 48-5
Effect of head weight distribution on loft

A number of years back, “low profile” type irons became quite popular among players who had difficulty getting the ball airborne and also hitting it solidly. The low profile irons may not be for everybody and in fact have given way to cavity back designs that share the center of gravity feature, but they do in fact work. The reason is mainly due to a more reduced center of gravity compared to conventional or larger type iron heads. See Figure 48-6. However, keep in mind that regardless of the iron head design, if the player contacts the ball in the center of the face with the iron head’s center of gravity equal to or lower than that of the golf ball’s center of gravity, the shot will most likely have proper trajectory and feel solid. Be cautioned not to visually compare irons or look at an iron and assume where its center of gravity is located. The head must be removed from the shaft, balanced on the face and marked because there are too many variables which control its location. Variables such as hosel length, hosel diameter, bore depth, loft angle, blade thickness, blade lengths, toe height and heel height all affect the center of gravity location.

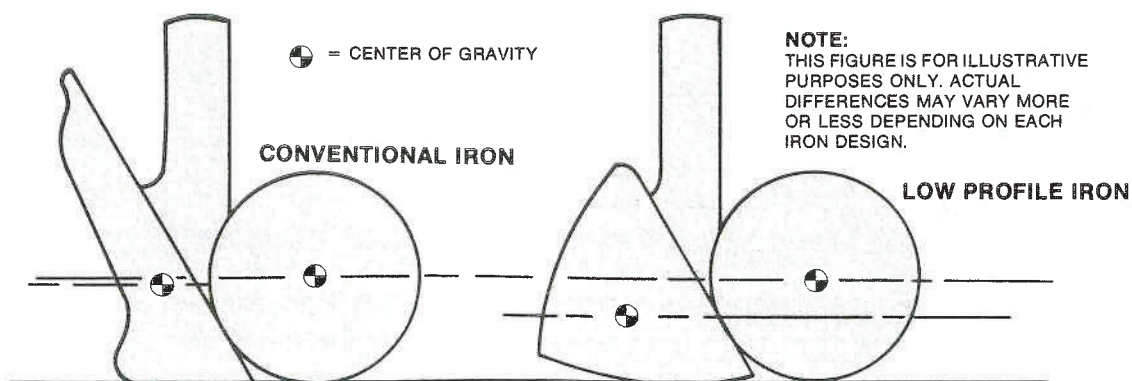
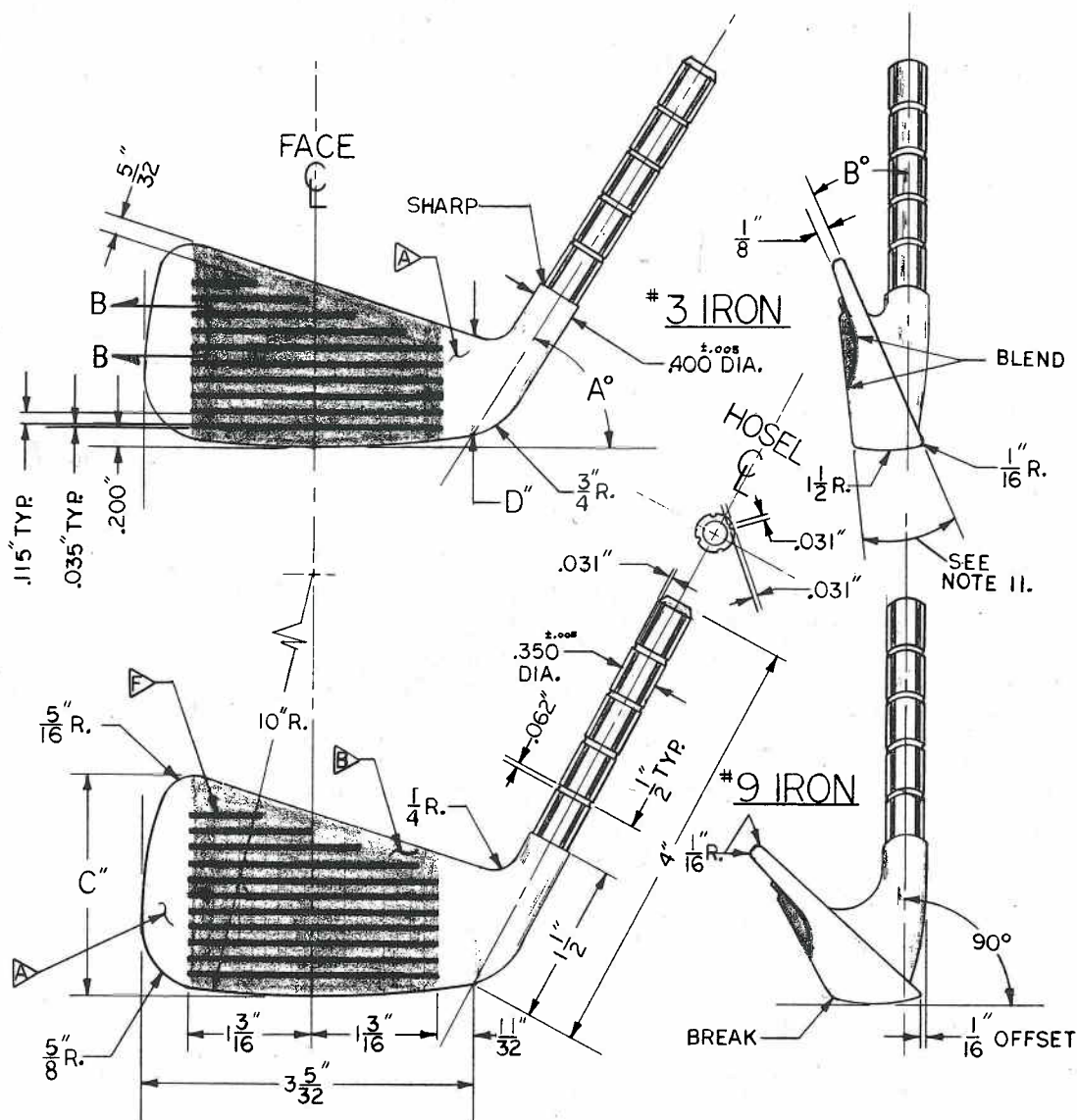


Figure 48-6
Comparing centers of gravity on conventional versus low profile irons

worth mentioning in greater detail. The following steps will show a method, which I feel produces an exact set of master models and ultimately exact wax reproductions from the mold. The first step to properly producing any golf club is to make engineering drawings. The drawing shown in Figure 51-2 is of a shaft over hosel assembly type that I designed and drew in the mid 1970's. The back of the iron and some notes and additional views are missing from this drawing, but it is not important for this discussion.



Iron No.	A° Lie	B° Loft	C° Toe Height	D° Heel Height	Finished Head Wts.
3	58°	24°	1.937	.937	261 gr.
4	59°	28°	1.968	.968	268 gr.
5	60°	32°	2.000	1.000	275 gr.
6	61°	36°	2.031	1.031	282 gr.
7	62°	40°	2.062	1.062	289 gr.
8	63°	44°	2.093	1.093	299 gr.
9	64°	48°	2.125	1.125	306 gr.
PW	64°	52°	2.125	1.125	314 gr.
SW	64°	56°	2.125	1.125	318 gr.

Figure 51-2

CAMBER — Referred to also as a rocker sole, radiused sole, 2 way and 4 way roll. The radius curve in the sole of an iron club, whether from toe to heel, or leading edge to trailing edge, or both. Hence, 2 way and 4 way radius.

COLLAR SHRINKER — An electric element used to reduce the size of trim collars by heating. This only works on certain trim collars made from a material capable of being shrunk under heat.

COLORCOTE — A paint used to cover the grain of a wood head during finishing thus giving an opaque look. Colorcotes can also be obtained in "see through" or non-opaque paints.

COMPOSITE — A combination of materials comprised of a base material and some type of adhesive to bind them together. Can come in a variety of forms ranging from fibers, particles or layers. Also, the principal term used to describe shafts made of more than one material.

CORRUGATION — *See Scoring.*

COUNTERSINK — (noun) A cone shaped tool used to enlarge the top part of a hole so that the head of a screw will fit flush with the surface. (verb) To modify a sharp edge such as found inside a hosel.

COUNTERBALANCING — Reducing the club's swingweight by adding weight to the grip end. Total weight increases and swingweight decreases.

CROWN — The highest point of the top radius of a wood head.

CYCOLAC — An injection molded plastic used for face inserts in wood clubs.

DECALS — Transfers or designs made from lacquer or enamel silkscreened on a special paper. Decals are usually applied to wood clubs and are available in water soluble or reverse image types which require a special solvent.

DEEP FACE — Wood heads that have a face height of 1 $\frac{1}{8}$ " or higher. Any wood head with a face height greater than standard.

DEFLECTION BOARD — A tool used to measure and compare the bending of one shaft to another. The butt end of the shaft is clamped and a 7 pound weight is hung from the tip end to create a bend or curve in the shaft. Readings are taken along the shaft and compared to readings taken from other shafts.

DELAMINATION — The separation of the layers of a laminated wood head or insert.

DIG — *See Scoop.*

DOWEL — A round wooden rod, usually $\frac{5}{8}$ " diameter, inserted into the butt end of a shaft for lengthening woods or irons.

DRAW KNIFE — A knife with a handle at each end used to remove old grips and underlistings.

DRILL REAMER — A tapered drill bit which is used to both enlarge and deepen a tapered bore hole.

DYNAMIC FITTING — Method of fitting golf clubs in which fitting decisions are made based upon ball striking tests. Gained credibility following the printing of Ralph Maltby's book, "The Complete Golf Club Fitting Plan."

EFFECTIVE LOFT (Also Real Loft) — The loft of a wood club when it is rolled into the square (0°) face angle position. Also the loft of a wood club when the face and shaft centerline are both perpendicular to target line.

END SCREW — A small screw, usually brass, installed through the bottom of through bore shafts that serves as a second locking screw. Seen usually on pre-1960 through-bored woods.

EPOXY — A two part resin used for adhesion, coating, casting, etc. It is mixed by combining a base and activator together causing an exothermic reaction to create a very strong bond.

FACE — The outlined or defined hitting surface of a wood or iron club.

FACE ANGLE — The angle of the face of a wood club to the grounded sole line with the shaft hole perpendicular to the line of flight.

FACE CENTERLINE — An imaginary line which bisects the head of a club in the exact geometric center of the face or insert.

FACE DEPTH — The measurement of the height of the face of a wood head or iron head on its centerline. Noted as either shallow, normal or deep.

FACE PROGRESSION — Measurement of the distance from the centerline of the shaft or hosel bore to the front leading portion of the clubface in both woods and irons.

FERRULE — A tapered plastic sleeve which forms a smooth transition from the top of the hosel to the shaft.

FILAMENT WINDING — The process for manufacturing a seamless composite shaft with continuous resin-impregnated "yarns" of graphite wound around a mandrel in a pre-determined pattern from tip to butt, forming a shaft.

FIRING PIN — A circular piece of metal installed in the center of some types of inserts. Usually aluminum or brass.

FIRST STEP — The first formed and defined visual transition to increased diameter in a golf shaft.

FLANGE — Term describing the elongation of the trailing edge of an iron club or putter.

FLAT LIE — The lie angle is more level or horizontal than the standard.

FLEX — The bending action of the shaft as it relates to the speed of the golfer's swing. A designation given to shafts to denote the degree to which they bend against industry standards.

FLEX POINT (Also known as "Kick-Point") — The location on the shaft where the bend is the greatest.

FLITCH — A solid or laminated rough piece of wood which will yield blocks and ultimately raw turned wood heads.

FLUTED SHAFT — A steel shaft that has channels formed vertically (longitudinally) in the shaft usually near the tip end.

FORCE FIT SHAFT — A tip taper wood or iron shaft to a tapered hosel head assembly.

FOREWEIGHTING(ING) — Locating weight in the face area of a club, done to bring the center of gravity forward in the clubhead. Usually done through installation of heavier insert material.

FORGING — One of the processes for forming iron heads. A metal bar is placed between two halves of a die and hammered under pressure into the rough shape of an iron head.

431 — A type of stainless steel used to make investment cast iron heads.

GATE — The buildup of metal on a raw investment cast iron or metal wood head that indicates where the metal was poured into the mold. Usually found on the bottom radius of the toe.

GATING — The grinding off of the excess metal left from the raw casting on the toe of an investment cast iron or metal wood head.

GOLF CLUB NAME TERMINOLOGY

Driver — Name given to the #1 wood.

Brassie — Older name given to a #2 wood.

Spoon — Older name given to the #3 wood.

Cleek — Older name given to the #4 wood.

Baffy — Older name given to the #5 wood.

Driving Iron — Older name given to the #1 iron.

Mid Iron — Older name given to the #2 iron.

Mid Mashie — Older name given to the #3 iron.

Mashie Iron — Older name given to the #4 iron.

Mashie — Older name given to the #5 iron.

Spade Mashie — Older name given to the #6 iron.

Mashie Niblick — Older name given to the #7 iron.

Lofter — *See Pitcher*. Older name given to the #8 iron.

Niblick — Older name given to the #9 iron.

Pitching Wedge — More of modern era iron club used to approach the green and for chipping.

Sand Wedge — An iron club used from sand or pitching from around the green.

Putter — The club designed for use on greens to stroke the ball into the hole.

GRAPHITE — A pure carbon mineral made into fibers, mixed with a resin and formed into a golf shaft. It is known for its very light weight and high strength.

GRAPHITE COMPOSITE — A golf shaft made of a low percentage of carbon graphite and a higher percentage of another material such as fiberglass.

GRIP MATERIAL — The substance from which any grip is made. The most common types are rubber, rubber and cork, rubber and cord, kraton and rubber and leather.

GRIT — The degree of coarseness of abrasive cloth or paper denoted by a number. The larger the number, the finer the grit or coarseness.

GROUND LINE — An imaginary line running from the clubface to back and perpendicular to the shaft centerline.

HEAD WIDTH — In a wood head, the distance from the farthest forward point of the leading edge to the farthest rear point of the back line.

HEEL — The lower back area of the hosel where the sole meets it.

HEEL/TOE WEIGHTING — Process of weight distribution whereby weight is relocated from the center of a wood or iron equally to the toe and heel. This process does not change the center of gravity but does improve off-center hits by putting more mass in these areas.

HOSEL (Also called the Neck) — Portion of wood or iron head that receives the shaft.

HOSEL OFFSET — The distance from the farthest front portion of the hosel to the farthest front portion of the leading edge at the face center.

IMPULSE PROFILE — Color computer generated graph demonstrating the loss of ball velocity for ball impacts from various points of the clubface.

INLAY — 1) Another term for an insert. 2) The wood or epoxy section set into the heads of some models of metal woods.

INSERT — A piece of material placed into a routed cavity in the face of a wood head, designed to improve the durability of the face from impact between the ball and clubhead. Also, used mainly as a decorative piece on metal woods and irons.

INSERT MATERIALS — Cycolac, epoxy, vulcanized fiber, aluminum, wood, radiated fiberglass, graphite, melamine, titanium, brass, phenolic laminate and acrylics.

INVESTMENT CASTING (*Also known as the "Lost Wax" process*) — A method of accurately producing iron heads, some soleplates and metal woods. A mold is made, and a wax is cast from the mold. This wax is dipped several times in a ceramic slurry or mixture which then hardens. The slurry is heated and the wax melts out (lost wax). Molten metal is poured into the slurry shell (invested) and allowed to cool.

KICK-POINT — *See Flex Point.*

KILN DRYING — The removal of moisture from wood by baking at elevated temperatures over a period of time.

LAMINATED — A type of wood head made by gluing thin strips of maple together.

LAYUP — The layup is the type of lamination in a wood head. Layups can be either edgegrain or sidegrain or a combination of both. Layup also refers to the various thicknesses of each layer of wood in a laminated head.

LENGTH - CLUB — The distance from the heel portion of the sole radius to the top of the grip cap. This definition is the traditional method.

LIE — The angle of the centerline of the shaft with the ground line, tangent to the sole at the centerline of the face.

LOCKING SCREW — *See Backscrew.*

LOFT - IRON — The angle of the face on its centerline to the centerline of the hosel bore, measured in degrees.

LOFT - WOOD — The angle of the face on its centerline to a line perpendicular to the sole line measured in degrees. Loft is then read at a point $\frac{1}{2}$ the distance of the face height.

LORYTHMIC SCALE — A type of swingweight scale measuring swingweight about a fulcrum point 14" down from the top of grip. Measurements are in the direct letter/number swingweight designation such as D0, D1, D2.

LOST WAX — *See Investment Casting.*

LOW PROFILE — Iron heads whose face heights are lower than the average.

MASKING — 1. The application of a lacquer or varnish to the face of a wood club to prevent stain from bleeding onto the face. 2. Covering the face and soleplate surfaces with tape prior to application of colorcote.

MASTER MODEL — The exact replica of a particular wood or iron head from which all the other heads will be copied.

MIRACLE TAPE (*Also known as "2 Way Tape"*) — A tape which is coated on both surfaces with adhesive. Used for grip installation.

MODULUS — The amount a material will deform when stressed. (i.e., High modulus graphite has a higher resistance to deformity (bending) because the carbon atoms lie closer together to form a stronger bond.

MOLDS — In the investment casting procedure, a 2 part cavity which exactly reproduces the iron or metal wood head by injecting wax into it.

MOMENT OF INERTIA — Measure of an object's resistance to twisting.

MORTITE — A non-hardening putty material used to build a dam around the insert cavity of a wood head before pouring the epoxy insert.

NECK — *See Hosel.*

NOSING — The removal of that portion of wood left on the toe by the holding locations of the turning machine.

OFFICIAL SCALE — A type of swingweight scale that bases its measurements about a fulcrum point 12" down from the grip end. Swingweight measurements are in direct ounce readings such as 20.3, 20.5, etc.

OFFSET (*Also called Hosel Offset*) — The distance from the farthest front portion of the hosel to the farthest front portion of the leading edge of the clubface.

OVERALL WEIGHT (*Also called Static Weight, Total Weight and Dead Weight*) — The measurement in grams or ounces of a golf club's actual weight.

SHAFT OVER HOSEL — Type of head to shaft assembly in which the shaft fits over the hosel. (*Irons or putters only*)

SHAFT STEP PATTERNS — The length and arrangement of the shaft's diameter changes (step downs) which indicate the flex characteristics of the shaft. Examples are ProFit, Jet Step, Dynamic and Propel II.

SHALLOW FACE — Wood heads that have a face height of $1\frac{3}{8}$ " or less. Any wood head with a face height less than standard.

SHEATHING — A cellulose acetate material that is cut into strips to make grip collars or whipping collars. It was predominantly used on older clubs.

SHIM — A small, thin piece of paper or metal that is installed between the shaft and hosel to tighten the head to the shaft during installation.

SLOPE ANGLE — The angle created by the intersection of the top line and sole line in an iron head.

SOLE — The bottom of a wood or iron head that would normally touch the ground.

SOLE ANGLE — The angle created in the sole of an iron between the sole line (front to back) and the ground. The three sole angles are bounce, square and scoop.

SOLE INVERSION — *See Bounce.*

SOLE LINE — With the clubhead in the proper lie and playing position, this is the line of contact of sole to ground running from the leading to trailing edge.

SOLEPLATE — The metal part attached to the bottom of wood heads to prevent wear on the bottom of the head. Another primary function of the plate is to increase the weight of the head. Soleplate materials are usually aluminum, brass, zinc and steel.

SOLE RADIUS — The amount of curvature of the sole of a wood or iron head, as measured from toe to heel. Usually ranges from four to eight inches of radius.

SOLE WEIGHTING — Distributing the weight on a wood or iron head as low in the head as it can be placed. This process is usually associated with low profile clubs and heavy soleplated woods.

SQUARE BORE METHOD — The method of drilling the hole for the shaft that results in the center line of the hosel being perpendicular to the sole line for any face angle.

STATIC FITTING — Method of fitting golf clubs using charts or rulers. Seldom do players actually hit shots.

STATIC WEIGHT — *See Total Weight.*

STEEL WOOL — Long fine fibers of steel joined together into pad or ribbon form and used as a light abrasive for leveling, polishing or cleaning.

STEP DRILLING — Making or enlarging the bore hole on a clubhead to receive a tapered shaft by using a series of three progressively larger drill bits to simulate the taper.

STEP PATTERN — The order and lengths of the individual steps in a golf shaft which are used to indicate shaft model or brand name.

STEP-TAPERING — In the manufacture of steel golf shafts, the procedure of progressively reducing the tube's diameter from butt to tip by squeezing the shaft down through a series of step dies.

STRONG (LOFT) — Less loft than is the standard for any given club.

SWINGWEIGHT — A measurement which indicates the weight distribution of a golf club about a fixed fulcrum point. It is expressed by a letter/number combination (A1, B2, C3, D1, etc.) or an ounce measurement (20.3, 20.5, etc.).

TACK-RAG — A cloth treated with a sticky compound which is used to pick up dirt and dust particles from a wood head prior to finish application.

TARGET LINE — An imaginary line drawn from the ball or clubface directly to the target.

TIP PARALLEL SECTION — The constant diameter of a golf shaft just below the first step down.

TIP SECTION — That part of a shaft from the tip end to the first step.

TIP TAPER SHAFT — A golf shaft with a tapering of its diameter in the tip section. This tapering is at a rate of .0075" per inch.

TOE — The point farthest outward of the clubhead on a wood or ironhead.

TOP LINE — The top of an iron head where the face and the back meet. This line can be sharp, blunt or rounded in shape.

TORQUE — The amount of rotational twist that occurs in a golf shaft during the swing.

TRAJECTORY — The pattern or shape of the flight of a golf ball with respect to its height and direction.

TWO COMPONENT POLYURETHANE — A type of polyurethane with an epoxy resin component commonly used on metal woods.