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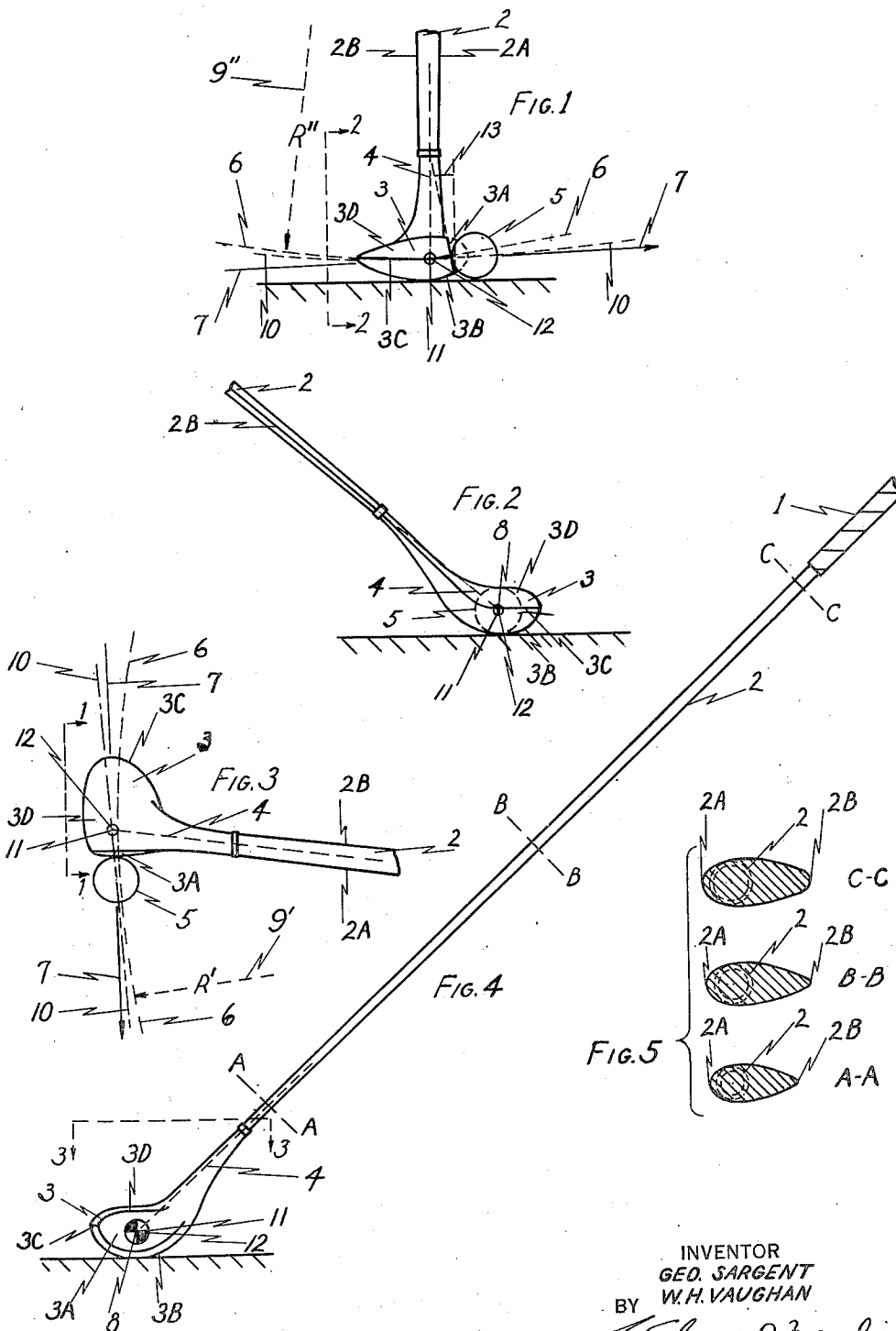
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2,088,095

GOLF CLUB

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2 Sheets-Sheet 1



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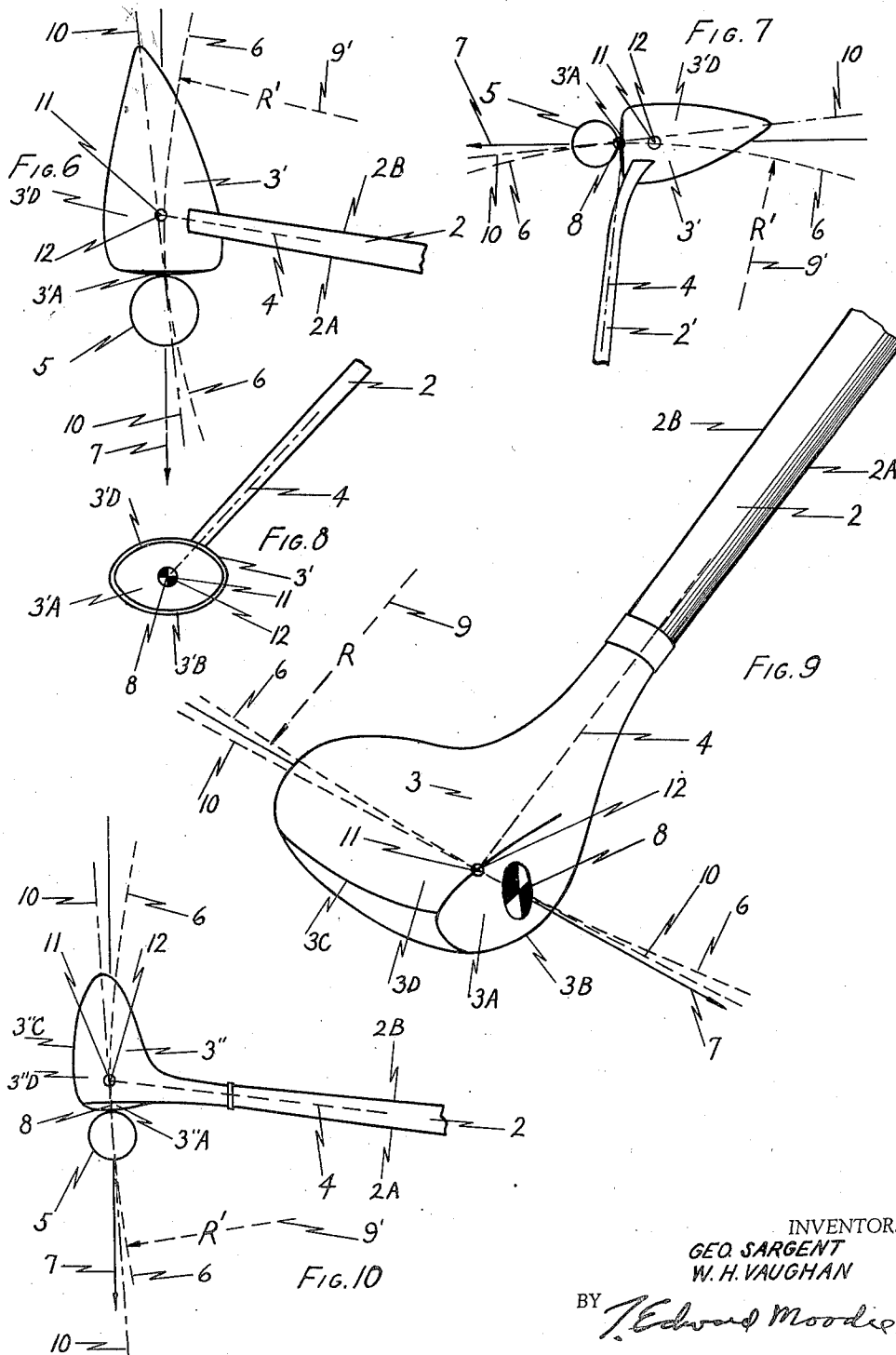
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UNITED STATES PATENT OFFICE

2,088,095

GOLF CLUB

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1 Claim. (Cl. 273—77)

This invention relates to an improvement in golf clubs, and has for one of its particular objects the provision of a club head, and/or shaft, of a shape such that it is retarded as little as possible by the resistance of the air.

A further object of the invention is to provide a club head so shaped that the shaft can be socketed therein in such a way that the axis of the shaft, if continued, would intersect the body of the club at a point directly back of the point which normally contacts the ball. Another object of the invention is to provide a golf club head which has a substantially streamline shape, said shape having such an angular relation with respect to the striking face of the club and/or the axis of the shaft that its median line is nearly coincident with the direction of the motion of the club head, considering both the horizontal and vertical components thereof, during that portion of the stroke just prior to the time that the ball is struck.

A still further object of the invention is to provide a golf club that is so formed, and attached to the shaft, that the aerodynamic forces resulting from its high velocity, and the inertia, dynamic, and impact forces, resulting from its acceleration in various planes, and its contact with the ball, are such that their resultant lies as nearly as possible in the plane of the club shaft thereby eliminating, in so far as possible, all tendency of the club to twist or rotate in the hands of the player and also eliminating as much as possible all sense of vibration, resistance, deflection, distortion, and flutter and decreasing to a material degree the shock which normally occurs when the club strikes the ball.

A further object of the invention is to provide a club of such form and construction that its weight can be materially increased, thereby increasing the energy which it possesses at any given velocity without affecting its normal feel, balance, and efficiency.

It is also an object of the invention to provide a golf club the shaft of which is so disposed with relation to the striking face that a continuation of the shaft axis would lie in the surface of said striking face or substantially so and intersect said face at the identical point that a properly struck ball would contact said face.

It is likewise an object of the invention to provide a golf club shaft of such shape that its cross section at any point resembles a streamline the median line of which substantially coincides with the path of the relative wind occur-

ring in that portion of the golf stroke during which the velocity of swing is a maximum.

In the drawings which form a part of this application and in which like characters of reference refer to like parts throughout the separate views:

Fig. 1 is a side elevation of the club head and the lower portion of the shaft at the instant of contact with the ball as seen from a position opposite the player. The plane of projection for this view is indicated by 1—1, Fig. 3.

Fig. 2 is a rear elevational view of the club head and the lower portion of the club shaft shown at the instant that the club head hits the ball. The plane of projection for this view is indicated as 2—2, Fig. 1.

Fig. 3 is a top plan view of the club head and the lower portion of the club shaft shown at the instant that the club head strikes the ball. The plane of projection for this view is indicated as 3—3, Fig. 4.

Fig. 4 is a front elevational view of the entire club shown in the position it would normally be in at the instant of contact with the ball.

Fig. 5 is a plurality of cross sectional views showing the shape of the shaft at the points indicated by the cutting planes A—A, B—B, and C—C.

Fig. 6 is a top plan view of a modified form of the club head and the lower portion of the shaft shown at the instant that the club head strikes the ball.

Fig. 7 is a top plan view of the modified form of club shown in Fig. 6 when seen at the instant that the club head strikes the ball and showing in this case a different form and arrangement of the club shaft.

Fig. 8 is the front view of the modified form of the club as shown in Fig. 6. In this case the ball is omitted although the position of the club is the same as that shown in Fig. 6.

Fig. 9 is a perspective view of the club head and the lower portion of the club shaft showing, insofar as possible, the relationship between the instantaneous radius of curvature, the path of the ball, the axis of the club shaft, the center of gravity of the club, the face of the club, the median line of the streamline shape, and the center of impact of the club face.

Fig. 10 is a top plan view of a second modified form of the club and the lower portion of the club shaft as seen at the moment of contact of the club head with the ball.

The invention which forms the subject mat-

ter of this application consists essentially of a new and novel form of golf club which, in most cases, will be in the form of one of the wooden clubs such as the driver, brassie, spoon, or short spoon, but in certain cases may be in the same form as one of the ten or more iron clubs. The handle 1 is conventional in every respect and does not form a part of this invention. The shaft 2 may be made of metal or wood and may be of solid, laminated, or hollow construction or it may be made of composite construction such as a tubular metal shape faired as desired by means of wood or similar material. In any case, the cross section shape of the club shaft at the points indicated by the cutting planes A—A, B—B, and C—C is such as to reduce the air resistance at these points to a minimum consistent with adequate structural strength. The outlines of the preferred streamline shapes to be used at the indicated locations are shown in Fig. 5 and consist essentially of a nose or leading edge portion 2A which is generally formed in the arc of a circle the center of which is well forward, and the radius of which is less than the radius of the basic shaft 2. The trailing edge portion 2B at the lower part of the club shaft consists essentially of a point or edge which changes as the shaft handle is approached until it forms a circle the radius of which may in some cases be greater than one-half the radius of the basic club shaft 2. It will be noted that in most cases the axis of the basic club shaft 2 is forward of the midpoint of the streamline shapes shown and may at times be as far forward as the quarter chord point. In certain cases a flat elliptical shape may be used in which case the diameters of the leading edge 2A and the trailing edge 2B will be equal and the axis of the basic shaft 2 will be located midway between the leading and trailing edges or nearly so. In any case the following limiting conditions will always apply.

1. The radius of the trailing edge will always be less than the radius of the basic shaft and will never be larger than the radius of the leading edge. In certain cases it may be zero or nearly so.

2. The radius of the leading edge will always be less than the radius of the basic shaft but will in most cases be at least one-half as great as the radius of the basic shaft and will always be as great as or greater than the radius of the trailing edge.

3. The radius of the basic shaft will in all cases be larger than that of either the leading or trailing edges and the axis of said shaft will never be located farther back than one-half the chord length or farther forward than 20 percent of the chord length from the leading edge of the section in question.

4. The leading edge, the basic section, and the trailing edge will be connected by a smooth continuous curve which acts as an envelope and is tangent to all three of the curves noted.

5. The maximum ordinate of the streamline section used will never be greater than 50 percent of the chord nor less than 20 percent of the chord of the section in question giving fineness ratios of from 2 to 5.

It will be understood that the limitations which are imposed on the streamline shapes as noted in items 1-5 above apply only to the shapes that are used on the shaft and not to the shape of the club head itself or to the fairing by which said head is attached to the shaft.

In the preferred form of the invention the axis 4 of the shaft 2 intersects the club head 3 at a point near the maximum ordinate of the streamline shape as seen in side view. The most important feature of our invention, however, is the offset given to the club head 3 with respect to the shaft 2 as seen in front or rear view. This offset is best noted by reference to the Figs. 2 and 4 in which it will be seen that the axis 4 of the club shaft 2 will intersect the body of the club head 3 along a line which, if continued, would pierce the vertical longitudinal plane of symmetry of a properly struck ball at a point lying in or directly back of the striking center of the club face 3A. By disposing the axis of the club shaft as just noted and by properly shaping the club head as will be later described, a golf club will be formed with which shots of great distance can be made even by a person comparatively unskilled in the game, since the aerodynamic, dynamic, and impact forces all combine to guide the club in a true path both before and after the ball is struck.

It will be readily understood by all those skilled in the game that the path described in space by the head of a golf club is of such a complex character that it is extremely difficult to show it accurately in a set of drawings. During the first part of the downswing of a golf stroke the golfer uses his body and wrists control the path of the club, the hand being held in such a manner that the right wrist is bent back considerably. During this phase of the stroke the weight of the body is transferred from the right foot to the left foot and at the same time the hands move around and downward without unlocking the wrists to any great extent. The club head moves downward rapidly and forward less rapidly and the radius of its path increases rapidly due to the fact that both the arms and the upper part of the body are changing their location in space as well as their location with respect to each other. This phase of the stroke continues until the hands are at a point slightly below the waist, at which time the golf club is practically horizontal, the left arm practically straight, and the right wrist is still bent back to a considerable extent. This first part of the stroke is largely an acceleration phase since the speed of the club head is increasing rapidly and its path in space is also changing. The motion of the club is in this part of the stroke largely downward and forward. It will readily be seen that the aerodynamic effects are comparatively slight except perhaps, at the last part of this phase, since the speed is still relatively slow. The mass effects are, however, most important even during this phase, and it is essential that the center of gravity of the club be so located that the acceleration forces do not set up any moment which might cause the club to twist or bend in the hands of the golfer, thus spoiling the latter part of the stroke. It will therefore be apparent that it is most desirable that the axis of the club shaft intersect the club head as far forward as possible and also well out from the heel of the club, thereby coming as close to the center of gravity as possible. It will be seen by reference to Figs. 1, 2, 3, 4, 5, 7, 8, 9, and 10 that in our invention such an arrangement is used. In these figures it will be noted that the axis 4, of the club shaft 2, intersects the club head at a point very nearly coincident with its center of gravity 11.

After the wrists uncock and the club shaft

passes below the horizontal position, the speed will be very high and the aerodynamic shape of the club head as well as the club shaft will become very important. Applicants are well aware that golf clubs have been given a streamline shape prior to their invention, but to those skilled in the art it will readily be seen that simply placing a streamline shape on a golf club will not result in any material advantage unless a certain form of structure is used. In this invention, applicants have discovered by continuous experiment that certain conditions must obtain in order to make an operable device.

Since, during the latter part of the golf stroke, where the aerodynamic forces are large, the golf club is still moving downward to some degree as well as forward, it is essential that any streamline shape which is used must have more camber on the lower surface 3B than on the upper surface 3D. For this reason, applicants have designed a streamline shape in which the median line 10 has a pronounced upturn as seen in side view and in which said median line coincides as nearly as possible with the path of the club head in space. In other words, the radius R of the arc of the median line as seen in side view is substantially the same as the vertical projection of the instantaneous radius of swing occurring just before the club strikes the ball. In a similar manner, the radius R' of the median line as seen in plan view is substantially equal to the horizontal projection of the instantaneous radius of swing occurring just before the club strikes the ball. It will thus be seen that the outboard edge 3C of the club head 3 will have a pronounced upturn, thus producing a club the aerodynamic drag of which is a minimum. However low the drag of the club head, the invention would still be inoperable unless the aerodynamic center 12 was located at such a point that any moments set up by the aerodynamic forces were small. It is well known in the aeronautical art that the aerodynamic center of a streamline shape is approximately at the quarter chord point or slightly forward thereof and it will be seen that in our invention the axis of the club shaft is so disposed as to come approximately at this point or slightly forward thereof thus giving aerodynamic stability to the club. The axis of the club shaft is also located in this way. At the instant that the club strikes the ball it is vitally essential that no moments be set up which would cause the club to twist in the hands of the player thus spoiling the stroke. In our invention we have so disposed the axis of the club shaft that the center of impact 8 of the club 3 lies directly ahead of the center of gravity 11, the aero-

dynamic center 12, and the axis of the club shaft 4, thus reducing to a minimum the impact moment which is transmitted to the club shaft and thus to the hands of the player. In fact, in one of the modified forms of the invention, Fig. 7, the axis of the shaft is so located that its continuation will intersect the striking face 3A of the club 3 at a point coincident with the center of impact.

In Figs. 6, 7, and 8 a modified form of the invention is shown in these views the axis 4 of the club shaft 2, the path 6, the club head 3, the instantaneous radius of swing 9, and the flight path 7 of the ball 5 are shown in the same manner as in the preferred form of the invention. It will be seen that in the modified form of the invention illustrated in Figs. 6, 7, and 8, that the club head is given an elliptical shape as seen in front view and a very much elongated shape as seen in plan and side views, thus more nearly approaching the ideal streamline shape. The axis 4 is in this form of the invention inserted at such a point on the body of the club 3' that its continuation will intersect the center of gravity and the aerodynamic center of the club without crooking the shaft as was done in the preferred form of the invention. In fact, the shaft 2'' could be crooked in a forward direction, Fig. 7, so that its axis 4 would, if continued, actually lie in the striking face of the club 3'' and intersect the center of impact 8.

In Fig. 10 an additional modified form of the invention is shown. In this form of the invention the construction is essentially the same as in the preferred form of the invention except that the club head is given a somewhat longer tail portion. This tail portion is given a double taper so that it not only decreases in thickness toward the trailing edge, but also becomes more pointed as seen in plan view.

Having thus described our invention, what we claim is:

In a golf club a shaft and a streamlined head having a median line which is curved on the same radius as that of the intended arcuate path described by the head in striking a ball, said club head having an impact point, a center of gravity and an aerodynamic center, said aerodynamic center being disposed directly back of the impact point and substantially coincident with the center of gravity of said club head, the shaft being so positioned with respect to the head that the axis of said shaft passes through said aerodynamic center and said center of gravity thereby obtaining playing stability for the club.

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