May 21, 1929. G. E. BARNHART 1,713,812

METHOD OF MAKING GOLF CLUB SHAFTS

Filed Dec. 13, 1926

Fig. 1.

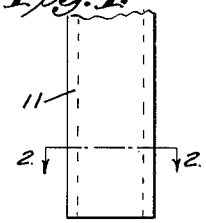


Fig. 4.

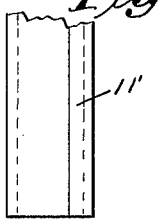


Fig. 2.



Fig. 5.



Carbonized before drawing

Fig. 3.



Fig. 6.

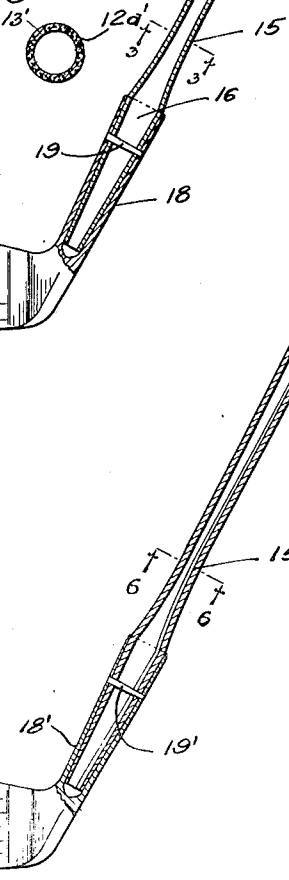
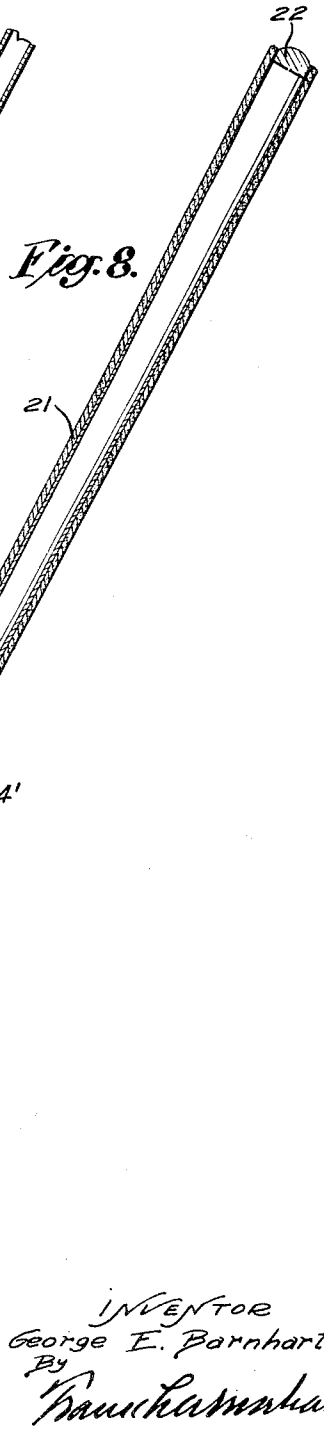


Fig. 7.

Fig. 8.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING GOLF-CLUB SHAFTS.

Application filed December 13, 1926. Serial No. 154,468.

Although my present invention is entitled as relating more particularly to the shafts or handles of golf clubs, it should be understood that this invention may be regarded as relating, somewhat generally, to the production of structural elements by stages which include both a carbonization and a drawing—as by the passing of metal through rotated drawing surfaces—the last-mentioned operation or operations being presumably followed by a heat treatment and/or other steps requisite to the completing of a desired product.

It is understood to have been common to subject drawn metallic articles to a carbonization subsequently to an elongation or other shaping of the same by swaging dies; but I have discovered that very superior results may be obtained if a taper-drawing or a taper drawing and rolling operation, or the like, is conducted subsequently to a carbonization. One notable effect of this sequence of operations is the compacting of a metallic wall of the article incidentally to the production and/or concentration of fiber therein, in such manner as to obviate any tendency toward sponginess in the final product, and the crystalline structure of the high carbon "case" or "skin" formed upon the metal is drawn down or so drawn and rolled as to be compacted into the main body of the metal in a manner favorable both to the appearance of the finished product and to the toughness and/or resiliency of the same.

Aiming at the production of golf club shafts and/or other structural elements from comparatively inexpensive seamless or "seam" tubing purchased under a specification prescribing a low carbon content thereof, I find that, by proceeding in the novel manner above referred to, carbonizing before drawing, I can produce golf club shafts of high quality. Using my method, even so-called "steam" tubing—such as may be produced, by bending and welding, from a sheet metal, or otherwise obtained at a very moderate cost, makes very satisfactory articles; and my invention may accordingly be regarded as relating to the production of high quality structural elements from either seamless or "seam" tubing, having the proper carbon or alloy content before drawing, the "seam" tubing being entirely satisfactory for most uses, although much less expensive; and, as hereinafter described, my invention may also be regarded as relating to drawn structural elements producible by the mentioned stages, and more particularly to units which are not only tapered but provided with walls of uniform thickness or with walls which are thickest in a region of minimum outside diameter.

Where "seam" tube is used, alloy or special carbon steel may be used—said alloy containing metals such as vanadium, nickel or molybdenum, together with the desired carbon content.

Other objects of my invention may be best appreciated from the following description of an illustrative embodiment thereof, taken in connection with the appended claims and the accompanying drawings, in which

Fig. 1 is intended merely to represent, in elevation, a part of a seamless tubular unit or stock suitable for use in the production of golf club shafts or other structural units by my novel process.

Fig. 2 is a cross sectional view which may be regarded as taken in such a plane as that indicated by the line 2—2 of Fig. 1,—this view being however intended primarily to symbolize, by a showing of small approximate circles within a wall area, the effects of a carbonization of a tube such as is shown in Fig. 1.

Fig. 3 is a view comparable to Fig. 2, but intended to symbolize the effects of a drawing subsequent to a carbonization,—the crystal or grain structure of the metal being here represented as smaller and a production of fiber by drawing, and the change in the physical characters, being suggested by minute crosses or X's.

Figs. 4, 5 and 6 are views corresponding respectively to Figs. 1, 2 an 3, but suggesting the use of a so-called "seam" tubing, rather than seamless stock, in the production of a structural unit by steps including a carbonization and a subsequent drawing.

Fig. 7 is a view showing a structural unit within my invention as embodied in a golf club,—walls of said unit being substantially uniform in thickness, and parts being broken away.

Fig. 8 is a view comparable with Fig. 7, but showing a structural unit, produced by the mentioned steps, as provided with walls which are thickest in a region of least diameter,—this unit being also shown as broken away, but nevertheless as provided with a special grip and a closure button at the upper end thereof.

Referring to the details of that specific embodiment of my invention chosen for purposes of illustration, a seamless tubing 11 or a "seam" tubing 11′ (see Figs. 1 and 4) (either of which tubings may have been formed from a low grade steel—as, from a 10–15 point carbon steel) may be carbonized in any usual or preferred manner up to between 40 points and 1 per cent of carbon (with an incidental increase in the thickness and crystallization in the walls thereof). During the carbonization a granular or crystallized condition tends to be developed in the exposed surfaces of the tube, somewhat as indicated (with diagrammatic exaggeration) at 12, 12′ in Figs. 2 and 5.

Subsequently to the mentioned carbonization (in which it should be understood that an alloy steel, such as a low carbon steel containing nickel, vanadium, or molybdenum, or the like, may be employed) I subject the mentioned tubes to a drawing or to a combined rolling and drawing operation, preferably producing a taper—this drawing being so executed as to effect an incidental compacting of the hard outer case of carbonized metal with the soft inner core of "low carbon" metal, at the same time producing an elongation of fibers therein,—somewhat as suggested by X's at 13 and 13′, Figs. 3 and 6, and decreasing the size of the grain or crystal formation somewhat as diagrammatically indicated at 12^a and $12^{a'}$. The figures last mentioned,—may be regarded as corresponding approximately to cross sections taken respectively as indicated by the line 3—3 of Fig. 7 and by the line 6—6 of Fig. 8.

As illustrated in Fig. 7, in case a structural unit, formed in the general manner indicated, is intended for use as a golf club shaft 14, it may have a substantially uniform wall, even though it be provided with a constriction 15 having a downwardly-tapered head-carrying enlargement 16 therebelow; and a head or plate 17, provided with a cooperating socket element 18, may be secured thereto by means such as a mere drive fit and/or a transverse rivet or tapered pin 19; but I also show, in Fig. 8, a structural unit in the form of a golf club shaft 14′, which is formed from a stock having a longitudinal seam 20 (which may have been formed, in advance of the described operations, by autogenous welding or the like); and, although this structural unit may have the same external configuration as that illustrated in Fig. 7, and either the same or a different alloy composition and fibrous structure resulting from carbonization before drawing, said drawing must be understood to have been so executed as to result in an upward thinning of the walls thereof, with increasing diameter, from a region 15′, having minimum outside diameter; and said drawing or rolling and drawing operation may also be so executed as to produce a downward thinning of a downwardly-diminishing portion adapted to fit within a socket 18′, shown as retained by a taper pin 19′.

It should be understood that structural units formed in the described general manner may be either thickest or thinnest in a region of minimum outside diameter, or of substantially uniform wall thickness throughout; and that units formed in the described manner may be used for any desired structural or other purpose,—my description of the steps of my process as applied to the production of golf club shafts being merely illustrative; and although, for the sake of completeness, I show the shaft 14′ as provided not only with a head or plate 17′ but with an external grip 21, and also with a cap button 22 constituting a closure at the upper end thereof (either or both of the last mentioned elements being advantageously formed from a composition such as bakelite and/or from a wrapping of fabric impregnated with such a composition) the features last referred to may be regarded as immaterial to my described method of producing metallic structural units.

Although I have herein described alternative embodiments of my invention, it should be understood not only that the stages set forth may be used in the production of hoe handles, masts or the like, but that various features thereof may be independently employed and also that additional modifications might be devised, by those skilled in the arts to which this case relates, without involving the slightest departure from the spirit and scope of my invention, as the same is indicated above and in the following claims,—in which the term "drawing" should be understood as including those operations in which a drawing action is accomplished by means which have also a rolling effect.

I claim as my invention:

A method of producing a metallic shaft which comprises: carbonizing a suitable steel tube; and subsequently subjecting the same to operations which include a drawing and a consequent production of fiber concentration in a region having a diminished diameter.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 6th day of December, 1926.

GEORGE E. BARNHART.