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Cornell

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[45] **July 30, 1974**

[54] **METHOD OF MAKING GOLF CLUB HEAD**

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[73] Assignee: **Cornell Forge Company,** Chicago, Ill.

[22] Filed: **Jan. 29, 1973**

[21] Appl. No.: **327,575**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 169,942, Aug. 9, 1971, abandoned.

[52] **U.S. Cl.** ..... **29/412,** 29/475, 29/526, 273/80.2, 273/167 R, 72/377

[51] **Int. Cl.** **B23p 17/00**

[58] **Field of Search** ..... 29/475, 428, 412, 414, 29/DIG. 20; 273/167 G, 167 R, 167 K, 80.2–80.8; 72/377 X

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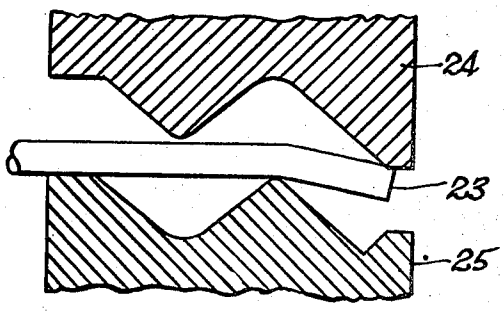
Primary Examiner—Charlie T. Moon

[57] **ABSTRACT**

A golf club iron head is made in two pieces instead of as a single piece forging in order to make possible appreciable economies in the forging of the head. The partition is made in the hosel, a short stub next to the blade of the club being made as a forging integrally with the blade and the remainder of the hosel being machined from a bar with an automatic screw machine. Alternatively the remainder of the hosel can be made from tubing suitably finished and cut off to length. The two parts are united by a permanent bonding procedure to form a substantially "standard" iron club head.

5 Claims, 16 Drawing Figures



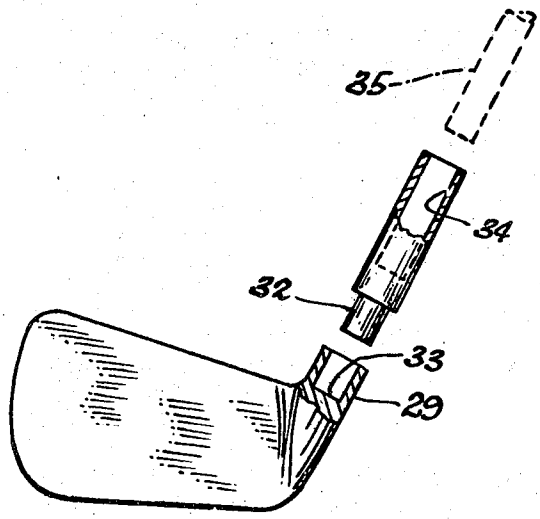


FIG. 1

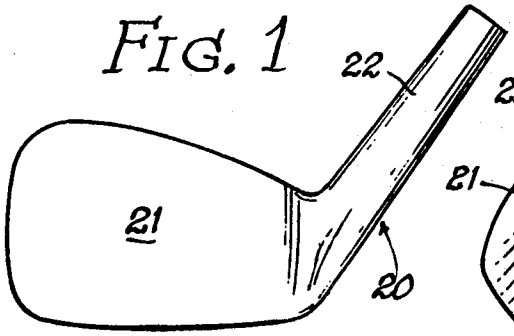
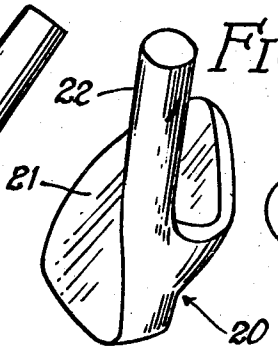


FIG. 2



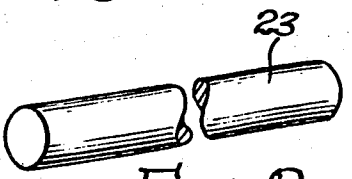


FIG. 3

FIG. 4

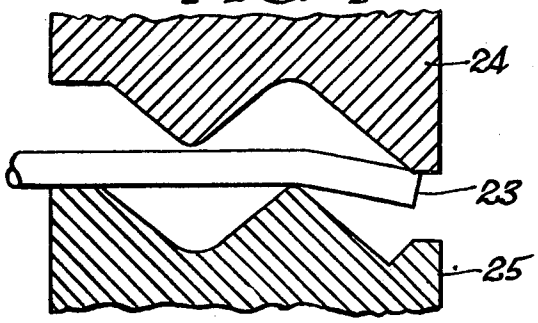


FIG. 5

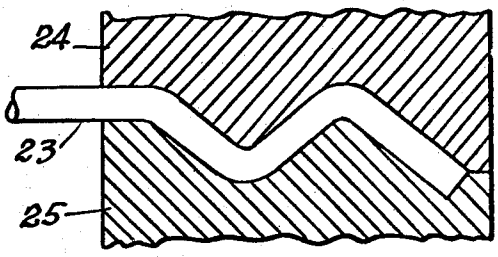


FIG. 6

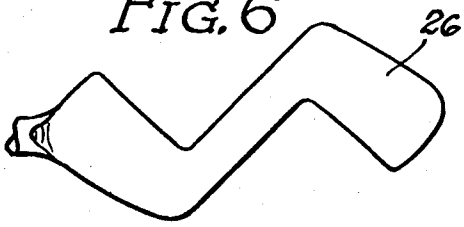


FIG. 7

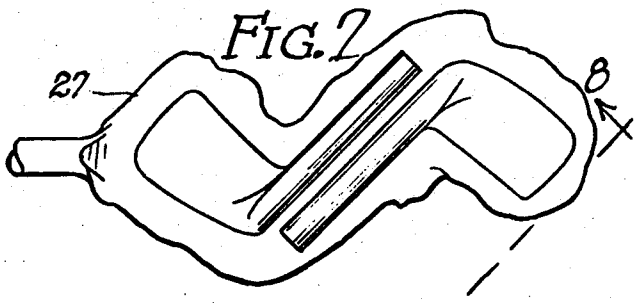
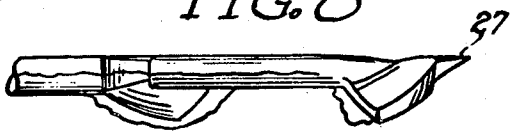


FIG. 8



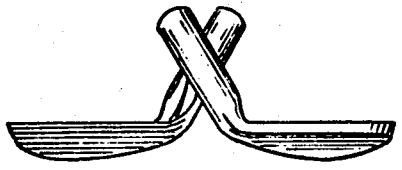


FIG. 9

FIG. 10

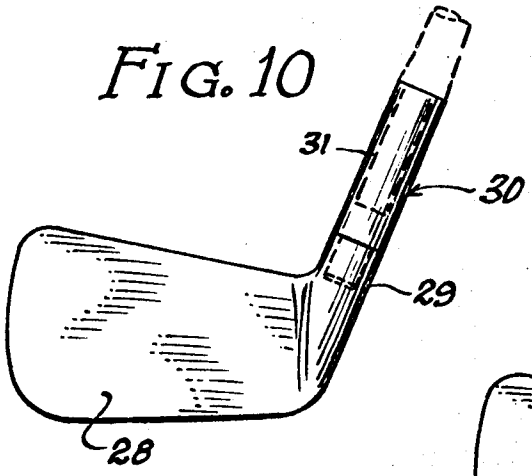


FIG. 11

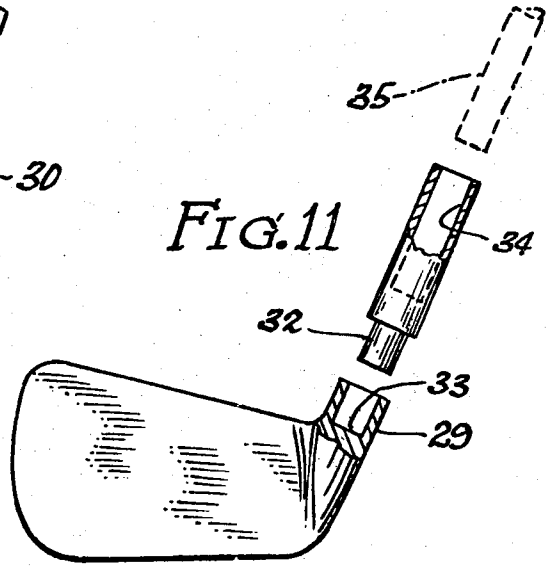


FIG. 12

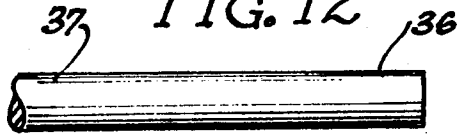


FIG. 13

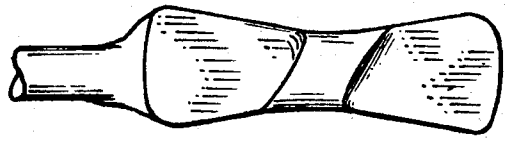


FIG. 14

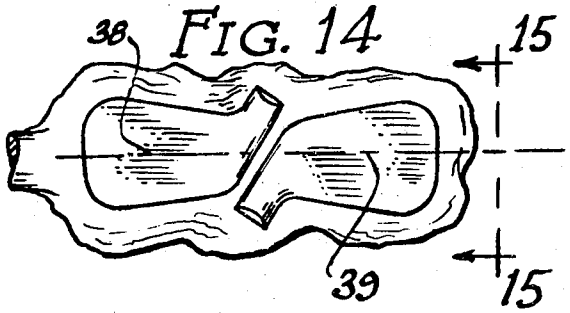


FIG. 15

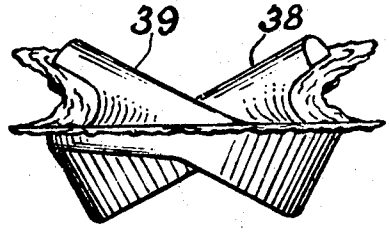
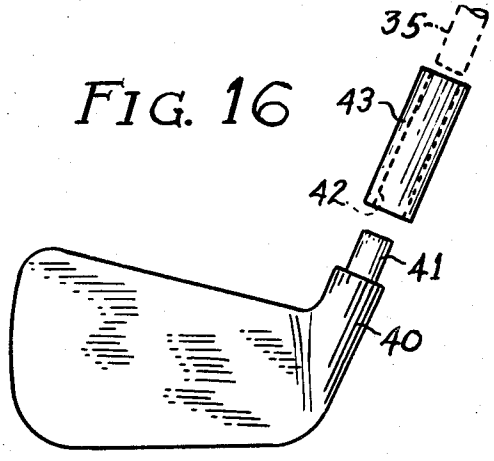


FIG. 16



METHOD OF MAKING GOLF CLUB HEAD

This is a continuation-in-part of my copending application Ser. No. 169942 filed Aug. 9, 1971, now abandoned for Golf Club Head and Method Of Making Same.

This invention relates to a method of making golf club heads.

Although golf club iron heads differ slightly from one another for a given numbered club in accordance with individual designers' preferences, they are almost universally made as forgings. The golf club head blade and the hosel by which the head is secured to the lower end of the club shaft are made integrally as a single piece forging, but since the blade size and shape and its angular disposition relative to the hosel vary as between differently numbered clubs, a number of problems arise in determining the most economical way to carry out the forging process.

Initially, iron club heads were made one at a time, starting with a long round bar the end of which was heated to forging temperature and then placed between staged forging dies to hammer the heated bar end into the desired shape. Where the heads are made of special metals, such for example as stainless steel, they may still be made one at a time. Good die design dictates that there be a minimum of "locks" or depressions in the die and that the head be as flat as possible, to minimize the depth of such locks as are unavoidable to obtain the desired golf club shape.

It has been appreciated for many years that substantial economies could be achieved in the forging of workpieces if two or more workpieces could be forged at the same time in appropriately designed multiple cavity dies. The same number of blows of the hammer spaced the same time intervals apart as are used in forming a single forged workpiece can form two or more workpieces, and thus twice as many workpieces are made per unit time using the same man hours as a single workpiece. In the forging process, however, longitudinal movement of metal in the dies is to be avoided since such movement results in undue wear of the dies by abrasion. The workpiece therefore should have such shape as to approach volumetrically at all sections from end to end the volume of the starting billet. Since the starting billet in the case of the golf club heads is a round bar, the forging process for them should arrange each head in the die in such manner as to satisfy the requirement of a uniform volume of metal from end to end of the die. Any substantial deviation from this requirement makes necessary the inclusion of one or more preliminary drawing operations to reduce the amount of metal in specified regions of the billet to match the requirements of the die. The ultimate test of the correctness of the die design is the uniformity of the flash around the workpiece as it leaves the forging die.

The hosel of a golf club head is relatively long and thin and has been found to require less metal per unit length than the blade of which it is an integral part. When such heads are made singly, a preliminary drawing operation is required to form the hosel. When, some 20 years ago, economic pressures required that the cost of forging club heads be reduced, various ways of forging two heads at once were thoroughly explored. It was found that the hosel required approximately one-half the metal used in the blade, and hence if the hosels

of two heads were disposed side by side in the die and the blades took the positions dictated by the desired shape of the finished club, the requirements of equal volume per unit length would be at least approximately satisfied.

The ideal arrangement of the club heads in the die would be to have the blades coplanar, but because of the angularity and length of the hosels, such side-by-side arrangement of the hosels would result in a crossing of the hosels and a correspondingly deep and thin lock in the dies which more than offset the advantage of forging two at a time. It was determined therefore that the hosels should be disposed parallel with one another and that the blades should be allowed to take the positions dictated by their angular disposition relative to the hosels. This made for a relatively long billet and hence limited to two the quantity that could be formed at one time in a die. The next multiple would have been four, and this would have required a long heated billet which, at forging temperature might bend of its own weight and complicate the handling of the billet.

Thus the forging of golf club heads has remained substantially unchanged for approximately 20 years, despite the existence of severe competition which would normally lead to changes directed toward cost reduction and the competitive advantage resulting therefrom. In view of the continual pressure for reduced cost of producing golf club iron heads and the advantages such reduction produces in the market place, it is one of the principal objects of this invention to provide a method of making golf club iron heads which substantially reduces the cost of such heads without appreciably altering the shape, appearance or "feel" of the club incorporating such head.

Another important object of this invention is to provide a golf club head the form of which has been designed with a view to eliminating undesirably large locks in a forging die by which it is made and to take greatest advantage of the economies of manufacture offered by the forging process.

As a more specific object this invention has within its purview the manufacture of a golf club iron head in separate parts, one by a forging process and the other by a screw machine process, and to unite the parts to form a complete head, the part made by a screw machine process being removed from the forging die to result in a golf club iron head which is substantially flat over its entire length and easily and economically made in multiple by the forging process.

These and other objects of this invention, will become apparent from the following detailed description of a preferred embodiment of the invention when taken together with the accompanying drawings in which:

FIG. 1 is an elevational view of a typical golf club iron head in finished form presently made by a forging process;

FIG. 2 is a side elevational view of the golf club head of FIG. 1 as viewed from the right in FIG. 1;

FIG. 3 is a round bar constituting the billet from which the head is made;

FIGS. 4–7 show the billet in various stages of formation into a golf club head by the prior art process;

FIG. 8 is an elevational view of the finished billet taken along line 8—8 of FIG. 7.

FIG. 9 represents an alternative arrangement of the club heads in a die;

FIG. 10 is an elevational view of a golf club iron head made in accordance with this invention;

FIG. 11 shows the head of FIG. 10 in exploded view, prior to assembly;

FIG. 12 is a view of the starting billet for making the head of FIG. 11;

FIGS. 13 and 14 show the head of FIG. 10 in various stages of formation;

FIG. 15 is an enlarged elevational view of the finished billet of FIG. 14, taken along line 15—15 of FIG. 14; and

FIG. 16 is an exploded view of a modification of the golf club head of FIG. 10.

According to the present invention, economies ranging from 20 percent to 35 percent in the cost of manufacturing golf club iron heads are achieved by making the head in two parts, one of which is made by the forging process and the other by a screw machine process, the two parts then being permanently joined or bonded to form a golf club iron head having the same shape and "feel" as the one presently made as a single piece forging. One part of the novel head comprises the blade and the base or lower portion of the hosel and is made by the forging process. The other part comprises the upper part or remainder of the hosel and and is round so that it can be made by the machining process. The upper part is suitably centered and dowelled into the lower hosel part and preferably bonded thereto.

The short hosel part formed integrally with the blade in a drop forge permits the disposition of two golf club heads in the dies with the ball-striking surfaces of the blades thereof substantially coplanar and aligned end-for-end with the hosels crossed and sloping upward. The coplanar ball-striking surfaces reduce locks to a minimum which is highly desirable, and the short stubby hosel part does not create any unduly deep locks such as would require a drawing operation. The two lower hosel parts, though crossed and not coplanar as in the prior art method together have a cross-sectional area approaching that of the billet from which they are made. The overall length of the heads arranged in a multiple cavity die is less than the corresponding dimension of the same two heads with long hosels arranged with their hosel parallel with one another. The reduced overall length thus makes possible the production of another pair of heads simultaneously with the first pair from an adjacent part of the heated rod, and effects a further economy in the cost of producing the heads.

Thus with reduced locks and substantially coplanar ball-striking surfaces on the blades, the method of this invention reduces the initial cost of the dies, reduces wear of the dies, and makes possible more reworkings of the die blocks before they become too thin and structurally weak in the drop forge. It also reduces the number of strokes of the hammer required to form a golf club head. The sum of these reductions amounts to from 25 percent to 35 percent of the former cost of forging a golf club head.

Referring now to the drawings for a detailed description of the invention, a comparison is made between the old and new methods. In the old method shown in FIGS. 1–8, FIG. 1 shows a typical golf club iron head 20 having a horizontally extending blade 21 and an upwardly extending hosel 22 formed integrally therewith. Blade 21 is inclined to the vertical as shown in FIG. 2 in varying degrees depending upon the club number. Hosel 22 is also inclined to the vertical as shown in FIG. 1 in the general plane of blade 21. It may be apparent that the volume of metal in the hosel is less than the volume of metal in the blade and is, in fact, approximately one-half that of the blade. Thus by placing two hosels in parallel side-by-side relation as shown in FIG. 7 the sum of the volumes of the two hosels approximates that of one blade. Two golf club heads can therefore be made simultaneously from a single heated billet 23 of round bar such as the one shown in FIG. 3.

The side-by-side arrangement of the hosels requires a saw-tooth shape in the billet in one plane. This shape is given the billet in a first stage in the dies 24, 25 shown in FIG. 4, the said dies in closed position being shown in FIG. 5. In these dies, any slight drawing of the billet to distribute the metal thereof more advantageously can be effected.

Following the bending of the billet into the sawtooth contour of FIG. 4, the billet is placed on its side in another section of the die to receive the preliminary shape 26 of the club heads, the metal being moved in a predominantly transverse direction as shown in FIG. 6. The final shape is given the club heads in the last section of the die as shown in FIG. 7, the excess metal being moved into the flash 27. If the die design is correct, and the manipulation of the billet in the die by the hammer operator is also correct the flash will be of substantially uniform width and thickness around the forging. The final stage is a trimming operation (not shown) in which the heads are separated and the flash is removed.

In the method and die design of FIGS. 1–7 just described, the two club head cavities in the dies are arranged with their hosels substantially horizontal and side-by-side so that their vertical profile will be low and hence will not require a deep lock. This profile is shown in FIG. 8. The blades take whatever position is dictated by their particular shape and angularity, and as may be observed, they necessitate the formation of some locks in the dies. Furthermore, the blades are not aligned with one another and they are separated by the long hosels, making for a long cavity in the die.

The alternative disposition of the two heads in a die would be to have their respective blades horizontal and coplanar and their hosels side-by-side, but extending upward at the angles dictated by the particular shape of the club head. Such disposition of the heads in the die is shown in FIG. 9. It is immediately apparent that the hosels 22 not only extend upwardly an intolerable distance, but they are crossed and require extensive drawing of the billet to fill the relatively thin and long locks in which they are formed. These insurmountable difficulties drove die designers away from the horizontal blade disposition of FIG. 9 for many years until the present invention and compelled them to use the parallel hosel disposition shown in FIG. 7.

I have discovered that the horizontal blade disposition with the crossed hosels heretofore thought to be impractical could nevertheless be used and with a marked reduction in cost of manufacture, provided that the construction of the club head was altered so that the forging process could be used for that part of the head for which it was particularly well adapted and that an inexpensive screw machine process could be used for that part of the head which lent itself especially well for that process. Specifically, I have found that the round hosel could be made cheaply as a screw

machine part, and the remainder of the club could be made by the forging process including the base of the hosel, and that the forged base of the hosel could be subsequently machined inexpensively to accept the screw machine-made hosel.

Advertng now to FIGS. **10–15** and first to FIGS. **14** and **15** it may be observed that when the blades are disposed in substantially horizontal position with their hosels adjacent and parallel to one another and the blades arranged with their center lines **38** and **39** substantially coinciding, only the round portions of the hosels would prevent the adoption of this arrangement in the dies (FIG. **9**). According to this invention therefore, the upper round hosel portions are eliminated from the forging process, leaving only the bases thereof as integral portions of the blades. The resulting profile as shown in FIG. **15** becomes immediately acceptable for the forging process. The hosels are then made separately by a screw machine process and joined to the base portions thereof on the blades.

The complete iron club head of this invention is shown in FIG. **10.** It is outwardly substantially identical to the club head of FIG. **1.** It has an identical blade **28** and the base **29** of the hosel **30** is integrally formed therewith. The round upper part of the hosel is shown at **31** and is machined to have an integral pin **32** (FIG. **11**) adapted to fit snugly into a corresponding recess **33** in the upper end of hosel base **29,** said upper hosel part **31,** in turn, having a cylindrical recess **34** to receive the cylindrical end **35** of the club shaft. The connection between pin **32** and recess **33** may be a threaded connection if desired, or it may simply be a bonded connection using an epoxy type of bonding agent. The connection between shaft end **35** and recess **34** may also be a bonded connection.

In the formation of the forged head of FIG. **10,** the starting billet may be the heated end **36** of a round bar **37.** Since only the bases of the hosels are formed in the forging dies, the club heads may be arranged as shown in FIG. **14** with their center lines **38, 39** as extensions of one another. This arrangement eliminates the bending step of FIG. **4** so that the first stage of the die can be used to spread the metal transversely to form the rough blade. This stage is shown in FIG. **13.** The second and final stage gives the heads their finished forged shape as shown in FIG. **14.** The trimming stage follows as in FIG. **7.**

Although the steps of forming a recess, assembling the upper hosel part to the blade and bonding the two together are additional steps with reference to the prior art FIG. **1** form, it has been found that the cost of the forging operation can be reduced to such an extent that the cost of forming and assembling the round hosel part as a machined part is readily absorbed and yet an overall saving of 25 percent in the cost of the finished club head can be easily achieved. Further substantial savings can be effected by forming four club heads simultaneously, the four heads being arranged in end-to-end relation. It may be observed, for example, that the overall length of the heated billet needed to form two heads as in FIG. **13** is shorter than that required to form the two heads of FIG. **6,** and hence no undue length of heated bar need be handled to form four heads simultaneously by the new arrangement.

The turned or screw-machine formed portion of the hosel is more simply made as a cylindrical part rather than as a part tapered downward toward the base as is standard design at present.

The tapered form yielded a tapered recess to receive the lower shaft end. Golf club shafts have for years been made from metal tubing having a series of cylindrical steps of progressively decreasing diameter formed therein from the grip end of the shaft to the head end. The last step, although initially made cylindrical like the other steps, was subsequently changed to a tapered contour to fit into the tapered hosel recess. The length of shaft for each numbered club is different and hence the taper had to be tailored to each club so that the manufacturer had to make and stock stepped shafts for each numbered club. By eliminating the taper, the manufacturer can make one length of stepped shaft and then cut the shaft to the length required for a given numbered club. The elimination of the tapering operation in forming the last step was recognized as desirable by golf club manufacturers because of the elimination of the expense of maintaining large inventories of shaft sizes, but the tapered hosel dictated a tapered recess which then made the tapered shaft end mandatory.

The present method produces a cylindrical hosel and a cylindrical recess and hence makes readily possible a cylindrical shape for the last step of the club shaft with its attendant lower cost for each shaft and reduced inventory size.

The golf club head of FIG. **16** differs from that of FIG. **10** in that the hosel **40** is not drilled as in FIG. **10,** but is formed in the forging dies with a pilot pin **41** which is finished by a recessed mill to fit with a snug fit into the lower end **42** of a tube **43** forming the upper end of the finished hosel. The shaft **35** of the club is inserted into the upper end of tube **43** until it abuts pin **41.** As in the FIG. **10** form, the tube may be bonded to pin **41** and shaft **35** with a suitable epoxy bonding agent.

Tube **43** may be made by an extrusion process, by a seamless welding process from sheet material or by a screw machine process. If made by an extrusion or seamless welding process, it is appropriately cut off to length from tube stock by a material removing process such as cutting, sawing or grinding.

The form shown in FIG. **16** reverses the location of the pin **32** and hence eliminates the drilling operation in the hosel of the head which is normally formed to taper toward the heel of the club. The taper provides a diminishing diameter of the hosel into which to drill and reduces the wall thickness of the hosel to a point where an undesirably high degree of accuracy might be required in the drilling operation.

Thus by departing from long established custom in the manufacture of iron golf club heads and dividing the heads into parts, each of which lends itself uniquely to a different, but for it, the least expensive process, a very substantial economy in the manufacture of a complete head is achieved. Not only are fewer strokes in the drop forge required to form the forged part, but a less expensive die results since the cavities are shallower and require less machining time for their formation. The shallower cavities make possible a greater number of reworkings of the dies when they become too worn for further use, before the die blocks must be discarded as too thin for further use.

Although the billet has been described above as being heated, it is contemplated that high-pressure cold

forming processes may be used instead, the arrangement of the cavities in the dies for the latter process remaining substantially the same. It is also understood that for the higher numbered club heads in which the angle of the blade relative to the hosel base is greatest some compromise may be made in the disposition of the blade in the die to avoid excessive angularity of the hosel bases with the horizontal. Such compromise, however, does not in any material way impede the use of the process of this invention.

I claim:

1. The method of making an iron golf club head having a blade, a substantially flat ball-striking surface on the blade, and a substantially round hosel extending angularly from said blade, said method comprising shaping a billet of iron of substantially cylindrical form by compression between dies to form the blade and lower portion of the hosel, shaping a substantially cylindrical bar of iron by a mechanical material removing process and joining the cylindrical bar to the lower portion of the hosel on the blade to form a complete hosel.

2. The method as described in claim **1,** said compression step comprising a series of blows struck by forging dies.

3. The method described in claim **1,** and including the further steps of forming a second golf club head simultaneously with said first-mentioned golf club head between dies, said second golf club head having a blade, a substantially flat ball-striking surface on the blade and the base portion of a substantially round hosel extending angularly from said blade, said dies having pairs of cavities forming two golf club heads arranged with their blades substantially coplanar and in end-to-end relation to one another.

4. The method described in claim **3,** and including the steps of arranging the blades in the die in space relation to one another and forming the base portions of the hosels for the heads as integral parts of the blades disposed in crossed relation to one another in the space between said blades.

5. The method of making an iron golf club head having a blade, a substantially flat ball-striking surface on the blade, and a substantially round hosel extending angularly from said blade, said method comprising shaping a billet of iron of substantially cylindrical form by compression between dies to form the blade and lower portion of the hosel, shaping a substantially cylindrical bar of iron by a turning process, and joining the cylindrical bar to the lower portion of the hosel on the blade to form a complete hosel.

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