

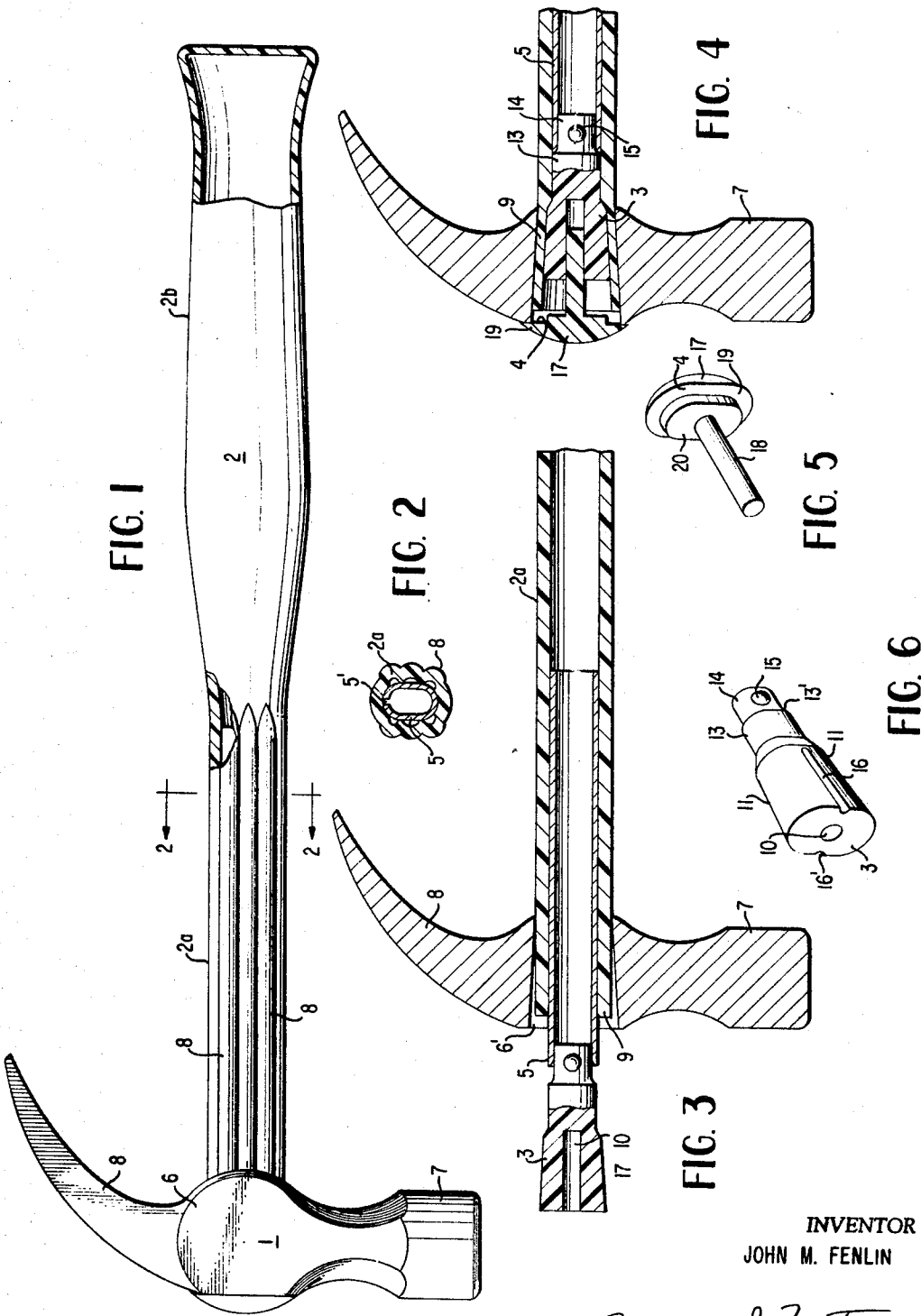
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PORTABLE IMPACT TOOLS

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PORTABLE IMPACT TOOLS

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ABSTRACT OF THE DISCLOSURE

An impact tool comprised of a striking head and a tubular plastic handle embodying an interior tubular metallic reinforcing member, the handle being fixed within the head by a wedge member bonded to the handle.

Cross-reference to related application

The present application is a continuation-in-part of prior application Ser. No. 426,650, filed Jan. 19, 1965.

Background of the invention

The invention pertains to portable impact tools such as hammers, axes and the like comprised essentially of a selected type of striking head and a cooperating reinforced tubular plastic handle of substantial transverse strength permanently anchored in the head by novel wedging means.

Description of the prior art

In the past portable impact tools generally have comprised essentially a striking head, usually composed of metal, and a cooperating wooden handle frictionally secured in the head by means of a wooden or metallic spreader or wedge. Except for the so-called indestructible hammers which are comprised of a metallic handle, the conventional impact tool of the type described comprises a metallic head having a medial section or poll formed with a handle-receiving eye or socket and integral terminal portions, one of which is a striking head, and the other a peening head or, as in carpenter's hammers, a bifurcated semicrescent claw. The handles of such conventional tools are usually comprised of a selected seasoned wood such as hickory or ash.

Although an impact tool, such as a hammer, is of ancient origin and of apparently simple construction, it must be carefully constructed to be satisfactory to a skilled artisan. The hammer, for example, must present the proper "balance" between the head and handle and the latter must possess a certain degree of inherent resiliency in addition to satisfactory impact, tensile and compressive properties to insure best manipulation of the tool. In case of claw hammers and similar tools, which are employed incidentally as levers for extraction of nails and the like, the section of the handle adjacent the head, where the greatest stresses are encountered, must have sufficient transverse strength to sustain the stresses incurred in use.

For these reasons, hammers as currently produced, generally considered, have been practically unchanged in material and design for generations. Although hammers are made in different sizes and the constituent parts, such as the striking head and peen or claw may vary widely in design, carpenters' and ball peen hammers usually comprise heads of various weight and tapered wooden handles of various lengths. These types of hammers have proven to be generally satisfactory but do present certain disadvantages. In an effective hammer of this type the wood chosen for the handle must be carefully selected and, as noted, is usually a special grade of hickory or ash. The proper grades of such woods are no longer abundant and cheap as attested by the fact that a top

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grade handle for a one-pound machinist hammer costs of the order of twenty-one cents.

An outstanding and universally recognized disadvantage of a wood handle is that, in use, the recurrent impact of the hammer head on the work tends to compress the portion of the handle within the head, thereby causing it to loosen within the socket as well as suffering a reduction in strength, thus engendering splitting or rupture of the handle in the area of highest stress, i.e., in the shank section adjacent the hammer head. Such condition is aggravated in the case of carpenters' hammers wherein the shank section is subjected also to repeated bending stresses encountered in use of the claw section. Despite the use of protective coatings on the handle, such as varnishes and the like, the wooden handle will tend to take up and lose moisture, depending on ambient atmospheric conditions which effect the handle deleteriously.

There is thus a real and long standing need for an improved impact tool, such as a carpenters' hammer which presents all the advantages of the strength and balance of currently employed wooden handles but which is more economical to produce and has much greater permanency in use. This need is less than adequately satisfied by the recently marketed hammers in which the older wooden handle is replaced by one composed of a solid, fiber-filled polyester. Such handle is relatively dense, as compared to its wood counterpart, resulting in unbalance of the tool; furthermore such handles are substantially impossible to fit in the hammer head by orthodox methods.

Summary

The invention concerns the provision of an improved impact tool comprised of an impact head formed with a specially conformed socket and a reinforced tubular plastic handle which is adapted to be swaged into anchorage contact within the head by a suitably conformed wedge which latter is adapted to receive a capping member to provide a desired external contoured surface at the front of the head without incurring expensive finishing operations.

Primary objects of the invention are to provide an improved impact tool comprised of a striking head and a relatively inexpensive steel reinforced tubular plastic handle of high impact resistance and transverse strength uniquely associated with a specially designed wedging member serving to inextricably anchor the handle in the head. The wedge member is adapted to be associated with a cap member to provide a finished external surface on the front of the head with minimal finishing operations. The tool produced according to the invention may be economically produced employing an inexpensive thermoplastic resin handle of desirable physical and chemical characteristics by a method which insures a finished tool of optimum physical properties.

Further objects and advantages will become apparent from the nature of the invention as exemplified in a typical embodiment illustrated in the accompanying drawings.

Description of the drawings

FIGURE 1 is a side elevation of a claw hammer with a portion of the handle shown in section;

FIGURE 2 is a cross-section taken on line 2—2 of FIG. 1;

FIGURE 3 is a longitudinal section of a portion of the structure shown in FIG. 1 illustrating the manner in which the hammer head and handle are assembled to produce the hammer;

FIGURE 4 is a longitudinal section of the head and an adjacent portion of the handle in the hammer in final assembled form;

FIGURE 5 is an enlarged detail view of cap member which is to be incorporated in the wedge; and

FIGURE 6 is an enlarged perspective view of the wedge component of the assembly.

Description of the preferred embodiment

The present invention invokes certain fundamental concepts of construction of an improved impact tool as disclosed in prior application, Ser. No. 426,650, and includes novel modifications of structure and technique to economically produce a hammer of special utility and desirable appearance. As explained in the prior application referred to, improved impact tools may be produced by forming the forged hammer head with a socket or eye which is tapered so that the four walls converge from the front of the head toward the rear adjacent the handle. The handle component of the hammer comprises a tubular member of a selected thermoplastic resin, one end of which was inserted in the socket and was swaged into intimate locking contact with the convergent walls of the socket by means of a plastic wedge wetted with an adhesive and then forced gradually into the end of the tubular handle.

In producing impact tools according to the described application, the terminal section of the handle is somewhat longer than the length of the socket and the wedge member was designed so that when in final anchorage position in the hammer head a section projected beyond the front face of the hammer head. Production of the finished hammer involved a series of finishing operations including rough grinding and fine grinding and sanding of the portions of the handle and wedge projecting beyond the front face of the hammer and hand painting the finished surface to provide the desirable smooth finish generally conforming to and merging with the contiguous surface of the head.

According to the present invention, improved finished hammers of the type described in the copending application may be produced by utilizing novel structure and technique which eliminates the labor and cost involved in finishing off excess material at the face of the hammer. Further improvements are achieved by utilizing a reinforcing metallic shank with a portion of the handle to provide the transverse strength required for the handle of a claw hammer, or similar lever type impact tools.

It is to be observed at this point that in hammer heads of the type contemplated herein which are produced by drop and press forging, the tolerance in the socket portion of the head may vary as much as one-sixteenth of an inch due to the wear on the forging die incident to normal wear during use.

According to the disclosure of the prior application, such potential variation in the tolerance in the socket of the head was compensated by selecting the length of the wedge such that on a hammer head with an initial minimum tolerance in the socket the rammed-in wedge and the terminal portion of the handle in the head-handle assembly projected about one half inch, more or less, and beyond the front end of the eye, and on sockets of greater tolerance, produced from worn dies, such standard wedge is forced substantially all the way into handle section within the socket. Such projection necessitated the described finishing operations.

As will be seen subsequently the improved technique of producing the impact tools of the invention involves the use of a wedge member of such length that no final grinding of excess projecting material is necessary; while by the use of a special insertable capping member the tool is provided with the desired finished surface.

Referring to the drawings, an embodiment is illustrated in the form of a claw hammer. As there shown, such hammer comprises four major components, namely, a metallic head 1; a hollow thermoplastic resin handle 2; a wedge or spreader 3, serving to anchor the handle in the head; a cap member 4 for the wedge and a metallic tubu-

lar reinforcing shank 5 positioned within the section of the handle adjacent the head and extending well into the handle.

In such illustrative embodiment the head 1 embodies a median or poll section 6 which is integral with a cylindrical flat impact section 7 on one side and a crescent bifurcated section 8 on the opposite side. In typical claw hammers of this type the sides or opposite walls of the socket are formed with a double taper, usually about 3°, in order to provide sufficient draft to pull out of the forging die. After removal from the die, the flash is pierced so that the socket is double tapered along its length. In sharp contradistinction to such conventional socket designs, as will be more fully described, hammers produced according to the present invention are formed with a socket which is tapered so that the four walls converge from the front of the head to the rear adjacent the handle. Utilizing currently employed techniques, convergence may be achieved using a suitably shaped plunger and cooperating die block.

The handle component 2 is composed of a hollow thermoplastic resin of selected physical characteristics. The thermoplastic resin used for fabrication may be any one of choice which has the desirable characteristics of suitably high impact resistance and flexural strength. Illustrative of such resins suitable for use are vinyl homopolymers, unplasticized polyvinyl chloride-acetate copolymers, polyvinyl acetate, suitable polyamides such as nylon, resin-type butadiene-styrene copolymers, polyesters and the like. These are all characterized by low moisture absorption, as compared to wood, and have satisfactory impact resistance, tensile and flexural strength. The preferred resin for the handle is a poly carbonate.

It has been determined that the most feasible and economical method of producing the handle is by a blow molding technique. This method, as is known, involves the entrapment of an as-extruded soft hollow body or parison of the selected resin in a suitable mold and introducing air under a suitable pressure into the lumen of the parison to inflate it into contact with the surfaces of the mold, then allowing sufficient time for the plastic to cool and stiffen to a self-supporting condition while the molding pressure is maintained after which the molded unit is removed and trimmed to remove flash. By employing such blow molding technique the handle may be conformed to any desired shape and contour in a single step to insure optimum impact, tensile and compressive properties in given sections of the handle by proper design of the mold. Also with a given mold contour or profile the strength of the handle in impact and shear may be widely varied by a predetermined selection or adjustment of the die orifice of the extruder which feeds the parison into the mold to increase or decrease the wall thickness of the parison and commensurately modify the wall thickness of the molded handle. Additionally, by the proper design of the handle and conforming the mold correspondingly, hand grips, stiffening ribs as well as aesthetic designs can be molded on the handle; the formation of such surfaces on a wooden handle would be impracticable because of machining costs.

To facilitate molding operations and confer optimum structural characteristics on the molded handle, it has been found advantageous to form the hollow thermoplastic handle in the general shape shown in FIGS. 1 and 3. As shown in the drawings the unitary handle embodies a shank section indicated at 2A and an integral merging handle grip section 2B. The handle may be formed in any desired cross-section. In the drawings the handle is shown as generally ellipsoidal in transverse cross section having a relatively long major axis and a relatively shorter minor axis. The relatively thick walled shank section 2A merges along a gradual vertical and horizontal slope into a relatively thinner walled enlarged handle section 2B. In typical handles, the end of the handle grip section 2B is flared outwardly as at 2B' to insure against slippage of the hand

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of the user. The hand grip portion may be surface embossed in the initial, as-molded, form or embossed subsequent to molding to provide a non-slipping gripping surface.

In the preferred structure, the shank portion is formed with a series of stiffening ribs 8 extending along its length from the hand grip section 2B to near the terminal unribbed reduced end 9 which fits within the socket of the head and terminates a short distance of about $\frac{1}{4}$ " to the rear of the forward edge of the eye. When in assembled position in the head the adjacent rear surface of the poll section 6 which serves as a stop or abutment during assembly and, in use, prevents relative longitudinal movement of the hammer head rearwardly of the handle.

The wedge component 3 comprises a solid member of a tapered cross section 10 generally corresponding to the cross section of the eye of the hammer head and an untapered extension. In the preferred embodiment the wedge is composed of a thermoplastic resin, preferably of the same composition or character as that of the handle. The wedge member comprises a tapered portion, the walls 11 of which converge on a taper of 1.5° , more or less, to conform to the taper of the socket of the hammer head and is somewhat smaller in cross section than the corresponding portions of socket. The wedge is formed with an untapered portion 13 and a terminal integral untapered section 14 of somewhat reduced cross-section. The reduction in the cross-section of section 14 as compared to that of untapered section 13 may be of the order of $\frac{1}{32}$ " to $\frac{1}{16}$ " and corresponds to the thickness of the hollow steel reinforcing shank 5. The terminal untapered section 14 is formed with indents or depressions or holes 15 for a purpose to appear. The tapered portion 10 of the wedge preferably is formed with a series of longitudinal grooves or channels 16 for the reception of an adhesive or lubricant to facilitate intrusion of the wedge into the terminal section 9 of the handle in a manner to be described.

As will be seen in FIGS. 4 and 6, the wedge unit 3 is formed with a central bore 17 extending into the tapered section 10 for a purpose to appear.

The steel reinforcing shank 5, as shown in FIGS. 2 and 3 comprises preferably a low carbon steel stock of about $\frac{1}{32}$ " to $\frac{1}{16}$ " thickness which, as shown in FIG. 2, is formed to conform to the shape of the interior of handle section 2A fitting therein with a slight clearance.

The longitudinal opposed unflanged edges 5' of reinforcing shank abut or substantially abut along their length to insure a certain degree of flexibility along the length of the shank.

As shown in FIG. 1 in the assembled tool unit the steel shank extends into the handle for a distance of 5", more or less, depending on the size of the tool and is coextensive with the shank section 2A and terminates in the vicinity of the arc at the junction of handle shank section 2A and grip section 2B.

In assembling the tool the forward portion of the shank 5 is fitted over the reduced untapered section 14 of the wedge and locked thereto by means of kicked in projections on the steel shank which locks into the holes or cups 15 by spring clip action. In such assemblage, as shown in FIG. 4 the terminal forward edge of the shank abuts the ledge 13' of untapered wedge section 13 and the shank constitutes a prolongation of the untapered section 13 of the wedge. It will be observed that in assembled position the extensions 13, 14 and the shank 5 provide a rigidifying core for the handle in the area adjacent the hammer head serving to limit undue flexure of the handle under impact or bending stresses encountered when the claw section is employed as a lever.

As explained previously, the head of the impact tool is so conformed with relation to the handle 2 and wedge component 3 as to insure a novel technique for securing the handle firmly in the shank of the tool head. According to the present invention, the shank 6' is formed with interior faces or walls all of which converge from the

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front to the rear of the poll section 6. This convergence of the eye or shank is designed to establish a novel cooperation with the thermoplastic handle and wedge component 3 to insure a solid and permanent anchorage of the handle in the hammer head.

In assembling the novel impact tool, the hollow thermoplastic handle 2 is positioned in a suitable frame or jig and the hammer head is slipped over the terminal unribbed handle section 9 with the forward ends of ribs 8 abutting the rear face of poll 6 and is held centered on the handle by the jig. The shank 5 is locked to the wedge extension 14 by spring action in the manner previously described. The wedge member 3 is then wetted or coated with an adhesive or a solvent by applying to the untapered extension and if desired to an area of the tapered wedge section over an area of an inch or more in length. The wetted or coated wedge is placed within the bore of the terminal section 9 of the handle and is forced by mechanical pneumatic or hydraulic pressure into the handle at such a rate as to preclude rupture of the plastic handle during the flaring or swaging of the section 9. The intrusion of the wedge into the handle is effected by employing a jig comprised of hinged sections adapted to be closed and locked and the interior of each of which sections conforms to and snugly abuts the exterior surfaces of the handle. In this manner, the handle is firmly locked against movement while the wedge is being intruded into anchorage or locking position.

It will be understood that as the wetted wedge is forced lengthwise of the handle, the solvent, adhesive or bodied solvent cement employed for bonding provides inherent lubricity between the handle section 9 and wedge and the adhesive, solvent or cement employed on the forward portion of the wedge is wiped backwardly to wet or coat the remainder of the wedge as it is forced into intimate mechanical contact with the contiguous surfaces of the terminal section of the handle, expanding or distorting the latter, as shown in FIG. 4, into intimate wedging contact with the convergent shank. It will be understood that the lubricant, cement, adhesive or solvent on volatilization or curing serves to intimately bond the contacting surfaces of the wedge and expanded handle section within the eye of the tool.

In wedging the handle into the hammer head various adhesives or cements may be employed such as casein glues, two part adhesive systems such as polyurethane or epoxies or one part systems such as rubber or welding adhesives.

Since the effective anchorage of the handle in the head is essentially effected by splaying or permanently distorting the terminal handle section 9 into intimate contact with the convergent socket, effective anchorage of the handle in the head may be achieved by the described technique without employing solvents or adhesives to prewet the wedge.

In the assembling operation after the wedge has been forced into position in the hammer handle to its maximum extent wherein it lies within the confines of the shank, as shown for example in FIG. 4, the pressure is relieved and the assembled hammer removed from the jig. In typical operations at this point the relative positions of the terminal handle portion 9 and the wedge 3 are as shown in FIG. 4 in which both the wedge and terminal portion 9 are within the confines of the shank with no handle or wedge material protruding beyond the point of the poll. In these circumstances the finishing operations described in the copending application are obviated by employing a simple capping member to close off the front surface of the poll and provide a desirable surface finish to the tool.

This is achieved by employing a finish or capping member of the type disclosed in FIGS. 4 and 5. As there shown, the member which may be composed of a thermoplastic similar to the material of the wedge or preferably an elastomeric material comprises a head or disc

portion 17 and an integral stem 18. As shown in FIG. 4 the exterior surface of the disc is formed on a curvature which conforms to the profile or curvature of the poll section of the tool and the edge of the disc is feathered at 19 to effectively merge into the contour of the poll section. The interior portion of the disc is cut away to provide a reentrant portion 19 and a central body section 20, the periphery of which conforms to and is somewhat spaced from adjacent walls of the eye of the tool. The diameter of stem 18 is substantially equal to that of the bore 10 of the wedge 3 and is so designed that in assembled position it does not protrude completely into bore 10. The total thickness of the disc may be of the order of $\frac{1}{4}$ ". In assembled form normally about $\frac{1}{16}$ " clearance exists between the disc and the front edges of the handle.

After removal of the tool from the jig the cap member is fixed in the unit by forcing the stem 18 into the bore 10 until the feathered edges of the disc firmly abut the subjacent surface of the poll. When elastomeric material is employed for the cap member the stem 18 is firmly and resiliently anchored in the stem to provide a completely finished tool with selected desired contours. If desired, prior to introduction of the stem 18 into the wedge, it may be coated or wetted with a suitable adhesive to effectively bond the cap member to the wedge.

It will be appreciated that utilizing a cap member of the type described obviates this finishing operation described in the copending application, facilitates assembly and provides a most desirable finished tool. The cap member particularly when composed of an elastomeric material may advantageously be used for light impact or tapping operations. Desirable aesthetic effects may be secured by suitably pigmenting the decor to obtain distinctive markings or effects.

It will be understood that within the scope of the invention various modifications may be made. Thus, if desired, the wedge member 3 may be comprised of metal and provided with reentrant surfaces or bights to enhance the locking effect of the wedge to the bore. Similarly, the interior surfaces of the eye may be formed with serrations or indents to increase the locking action of the splayed handle in the socket; such locking action may be supplemented by coating the socket with a suitable metal to plastic adhesive.

While for purposes of illustration the invention has been described as embodied in a particular impact tool, it will be understood that such principles may be embodied in a wide variety of impact tools having striking, cutting, peening and lever heads. The useful scope of the invention is thus not to be limited to the illustrative embodiment except as such limitations are imposed by the appended claims.

I claim:

1. An improved portable impact tool comprising a striking head formed with a handle-receiving socket extending through the head, all surfaces of the socket converging from the front to the rear of the head; a preformed

hollow thermoplastic resin handle, said handle having a terminal divergent flared section tightly abutting all contiguous surfaces of said socket; a wedge member having a convergent section within and abutting the contiguous surfaces of the flared section of the handle and an untapered section extending into the handle, the tapered section of said wedge being formed with a central bore; a cap disc member having an integral tubular shank fitting into and tightly abutting the surface of said bore, said disc member overlying the terminal end of the flared section and the exterior edges of said socket.

2. An impact tool according to claim 1 in which the untapered section of the said wedge extends into the handle to the rear of said shank, a tubular metallic reinforcing member anchored on the untapered section of the wedge, said reinforcing member lying in close proximity to the interior of the handle and extending into the handle for a substantial portion of the length thereof.

3. An impact tool according to claim 1 in which the said handle embodies a rear enlarged hand grip section and a forward shank section of reduced cross-section.

4. An impact tool according to claim 1 in which the striking head is formed with an impact face and an integral opposite bifurcated claw section.

5. An impact tool according to claim 2 in which the shank of said cap disc is bonded to the internal surface of the bore of said wedge.

6. An impact tool according to claim 1 in which the said wedge member is comprised of a synthetic resin.

7. An impact tool according to claim 1 in which the convergent section of said wedge is bonded to the contiguous surfaces of said flared section of the handle.

8. An impact tool according to claim 1 in which the hollow thermoplastic handle is comprised of a polycarbonate resin.

9. An impact tool according to claim 2 in which the metallic reinforcing member comprises a hollow steel shank having closely abutting longitudinal edges.

10. An impact tool according to claim 2 in which the said handle embodies a rear enlarged hand grip section and a forward shank section of reduced cross-section and a metallic reinforcing member anchored on an untapered section of the wedge, said reinforcing member lying in close proximity to the interior of the handle section of reduced cross-section and extending substantially the full length of said shank handle section of reduced cross section.

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