Aug. 1, 1961 G. W. YEARLEY 2,994,353

STRIKING HAND TOOLS

Filed Sept. 24, 1956 2 Sheets-Sheet 1

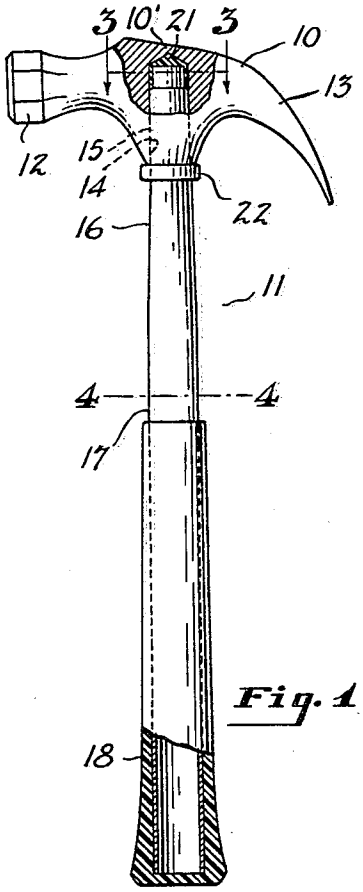


Fig. 1

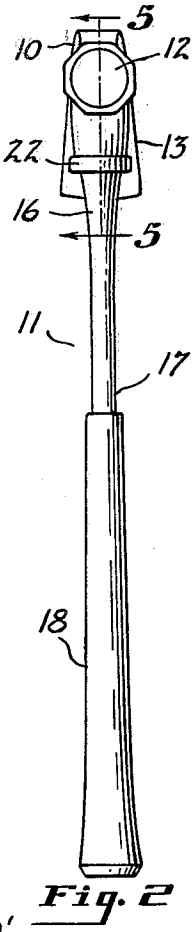


Fig. 2

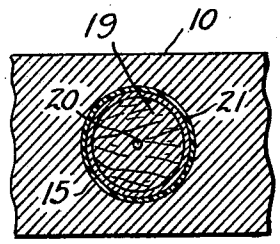


Fig. 3

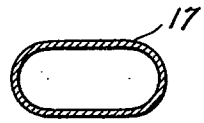


Fig. 4

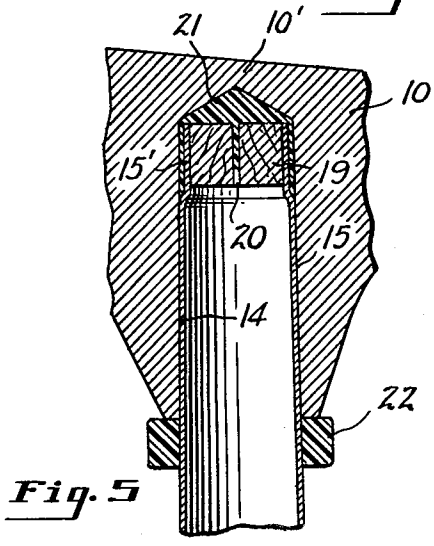


Fig. 5

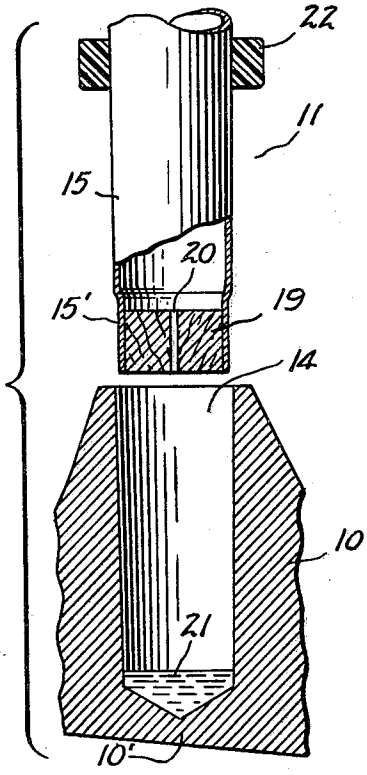


Fig. 6

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STRIKING HAND TOOLS

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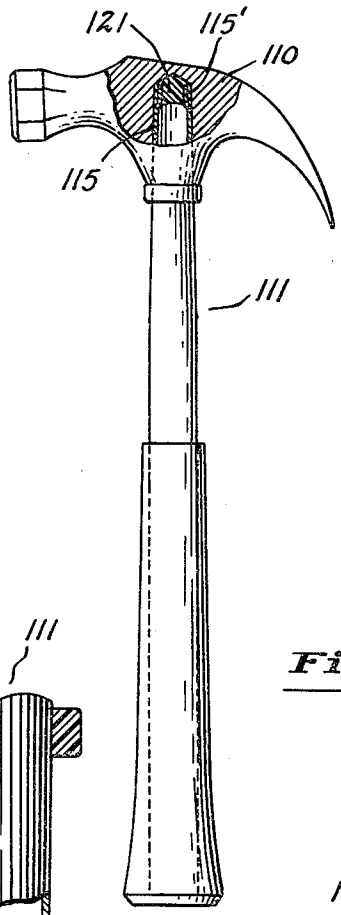


Fig. 7

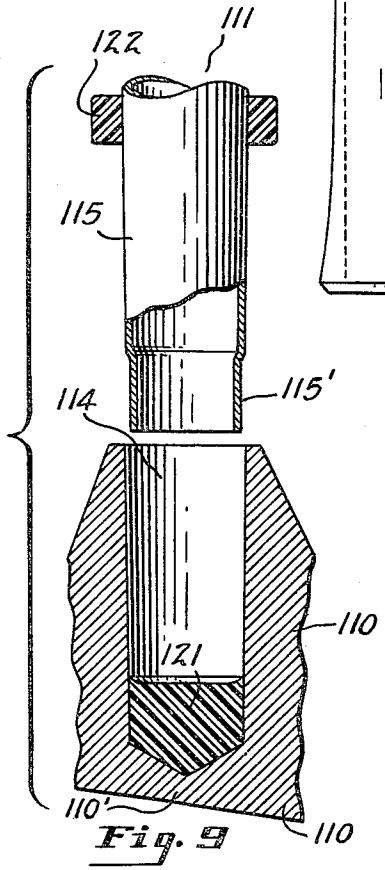


Fig. 9

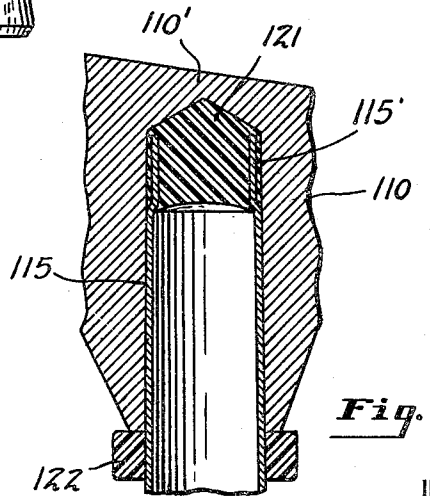


Fig. 8

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2,994,353

STRIKING HAND TOOLS

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8 Claims. (Cl. 145—29)

My invention relates to striking hand-tools and relates more particularly to hammers, hand-axes and the like.

My invention further relates to the provision of a striking hand-tool of the above types wherein a thin-walled tubular metallic handle, of tempered steel or like metallic material, is rigidly secured within an eye socket of the head of the tool.

My present invention provides an improvement to tools of the above type, which is particularly directed to the attachment of the handle to the head of such tool. I propose to secure the tool head to a thin-walled tubular metallic handle by means of adhesive, such as resins of the polyamide and epoxy types and to utilize the same in an improved manner, achieving a rigid junction between the tool head and such handle.

It is an object of my invention, therefore, to achieve the attachment of an upper end of a thin-walled tubular metallic handle to the head of a striking hand-tool of any of the foresaid types, in an improved manner.

A further object of my invention is to provide an improved shock-absorbent striking hand-tool of the above type, wherein attachment of the handle to the head of my improved hand-tool will withstand sudden stresses far in excess of those to which such a tool is ordinarily subjected.

Still another object of my invention is to provide an assembly of handle and head in a tool as above described which will be strongly resistant to the effects of shocks, moisture, heat and other deleterious effects to which tools of this class are commonly subjected.

A further object of my invention is to provide an improved striking tool of the above shockless type described which will be inexpensive to manufacture and at the same time will be highly efficient in use and which will be highly durable and shock resistant.

These and other objects of my invention and the invention itself will be readily understood by reference to the accompanying figures of drawing and the descriptive specification which relates thereto, in which drawings:

FIG. 1 shows in side elevation an embodiment of my invention which in this specific case displays a striking head for a claw-hammer;

FIG. 2 shows in front elevation the striking hand-tool of FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 1;

FIG. 5 is an enlarged sectional view taken along the line 5—5 of FIG. 2;

FIG. 6 is an exploded view of the parts of my invention as shown in FIG. 5, said parts being in an inverted position relative thereto;

FIG. 7 shows, in generally side elevation, a second embodiment of my invention, similar to FIG. 1;

FIG. 8 is an enlarged sectional view of a portion of the embodiment of FIG. 7;

FIG. 9 is an exploded view of the parts of my invention as shown in FIG. 8, said parts being in an inverted position relative thereto.

Referring now to the drawings, in all of which like parts are designated by like reference characters, it will be noted that although my invention is shown applied to a claw-hammer of any preferred size, it will be obvious that such method of attachment could be applied to various other tools and devices.

Referring now particularly to the hammer of my invention as shown in FIGS. 1 to 6 inclusive, at **10** I show a hammer head preferably constructed of steel, to which is rigidly and permanently attached a thin-walled tubular metallic handle **11**, the walls of said handle being preferably, in the form shown, substantially .038 inch in thickness for a tube having an approximate mean outer diameter of .625 inch. The head **10**, in the form shown, has the conventional shape of a hammer having a forwardly disposed striking portion **12** and a rearwardly and downwardly extending claw **13**.

Intermediate the striking portion **12** and the claw **13**, the head **10** is provided with an imperforate eye portion in the form of a socket recess **14** disposed vertically a substantial distance through the central portion of the head, an end wall **10'** affording a limit for the socket recess. The socket recess **14**, in the form shown, is circular in cross-section and the longitudinal walls of said socket recess converge slightly as said walls extend from the recess mouth in the direction of the end wall **10'** the rate of such convergence being preferably about .0075 in. per inch, in the tool shown.

The thin-walled tubular metallic handle **11** of the tool is provided at one end with a slightly tapered, cross-sectionally circular shank portion **15** of such size and taper as to correspond with the dimensions of the socket recess **14** in the head **10** of the hammer, wherefore the handle may be rigidly press-fitted therewith.

Immediately adjacent the slightly tapered shank portion **15**, a portion **16** is provided in the handle **11** which is transitional from the circular cross-sectional shape in the shank portion **15** (FIG. 3) to the flattened and elongated cross-sectional shape in the lower gripping portion **17** of the handle (FIG. 4).

Encasing the lower gripping portion **17** of the handle **11** over most of its length is a grip support **18** made of rubber or the like material and cohering firmly to the grip portion.

The slightly tapered shank portion **15** of the handle **11** is provided at its extreme upper end with a circumferentially reduced tip portion **15'** into which is driven a tightly fitting circular plug **19** preferably manufactured from hard wood or other material. The circular plug **19** is axially bored through its entire length thereby forming a passage **20**, approximately 1/16 inch in diameter in the size hammer herein specified, the purpose of which passage will later herein be fully described.

In FIG. 5, I show in cross-section a detailed view of the completed assembly of the head **10** and the handle **11** wherein the tapered shank portion **15** of the handle **11**, with the plug **19** securely in place in the reduced tip portion **15'** thereof, has been press-fitted under extreme pressure into the complementarily shaped socket recess **14** to a longitudinal extent which is slightly greater than that required to interfit said shank portion and said socket recess, and in such a way that the circumferentially convex wall surfaces of said shank portion **15** are compressively engaged with the circumferentially concave wall surfaces of said socket recess **14**. The engaged wall surfaces of the shank portion **15** are thus circumferentially resiliently compressed and exert a substantially high degree of retractive expanding pressure against the relatively interfitted walls of the said socket recess **14**.

The space between the outer circumference of the reduced tip portion **15'** and the slightly converging wall surfaces of the socket recess **14**, and the space between the uppermost end of the tip portion **15'** with the plug **19** secured therein and the end wall **10'** at the innermost depths of the socket recess **14**, are uninterruptedly connected around and across the top of the tip portion

15' and the plug 19, as viewed in FIG. 5, by filling the same with an adhesive bonding material 21.

The preferred bonding material 21 is of a type which hardens, when cured, or allowed to cool or set, into a solid mass uniting the handle 11, at its tip portion 15', with the head 10, making it integral therewith. The result of the uniting or bonding of the handle to the head of the tool, in addition to and in cooperation with the tight compressive fit of the parts, is to produce an assembly of greatly improved resistance to loosening by pulling, twisting or the application of sudden stresses thereto.

Materials suitable as bonding compounds as applied to my invention are various, among them being resins of different kinds, plastics, solders and other adhesives. It is also obvious that the preparation of the surfaces to be united would vary with the choice of bonding material, there being in some cases the need for chemical preparation or, as in the case of solder, preparation by tinning. In the case of a resin or plastic, the curing would be effected by maintaining the assembled tool at the proper temperature for a given length of time and the hardening of solder would be brought about by cooling.

My own choice of material for use as a bonding compound is a thermosetting adhesive combining versatile polyamide resins containing polar amine, carboxyl and amide groups, with epoxy resins, and a filler. Polyamide resins are known for their adhesive qualities as are the epoxies, and when combined properly result in a superior thermosetting adhesive which combines the best properties of both resins. The combination of polyamine and epoxy resins results in a chemical reaction between the amine groups of the polyamides and epoxide groups of the epoxies forming a three-dimensional or cross-linked polymer.

The result of this chemical polymerization is a polyamide-epoxy resin blend which will cure or harden to a strong thermoset product, which is excellent for adhesive purposes, coheres tenaciously to a wide variety of surfaces including metal, and is highly resistant to impact or shock, change of temperature, fatigue, and aging.

The addition of a filler to the preferred polyamide-epoxy blend, which I use, can increase greatly the tensile shear strength thereof. Materials used for this purpose include asbestos fibre, aluminum oxide, powdered iron oxide, alpha cellulose floc, wood flour, and calcium carbonate.

One advantage of this type of bonding compound is the relatively low curing temperatures required and the short duration of the application of heat. In addition, the use of pressure to assure good bonding is not necessary.

An example of the particular polyamide-epoxy adhesive blend which I have found to give excellent results as applied to the details of my invention, is as follows:

	Percent weight
Polyamide resin	42.0
Modified epoxy resin	42.0
Calcium carbonate	16.0

The above described blend can be cured by the application of relatively low heat sustained over a predetermined period of time, such as 300° F. for a period of ten minutes. Lower temperatures may well be used if the curing time is accordingly increased.

Referring now to FIG. 6, the procedure for assembling the tool 4 whereby my invention is illustrated, is as follows:

The outer circumferential surfaces of the reduced endmost tip portion 15', which is of relatively shorter length than its preceding shank portion 15 on the handle 11, are roughened, as by grinding or sanding, to insure a good bonding surface. The plug 19, having the passage 20 axially bored therethrough, is then driven into tightly fitting engagement with the inner circumferential wall surfaces of the tip portion 15'. A decorative ferrule 22, if used, is telescoped over the shank portion 15 and positioned at this time as seen in FIG. 6.

The head 10 of the tool is held or placed in either an inverted position as shown in FIG. 6 with the socket recess 14 opening vertically upward, and the end wall 10' of the head 10 forming the bottom of said socket recess or in an upright position as shown in FIG. 5. Adhesive bonding material 21, in an uncured or liquid state, is poured, as illustrated in FIG. 6, and inserted as in FIG. 5, into the socket recess 14 in sufficient amount as to fill the previously described spaces surrounding the reduced tip portion 15' and the inwardly disposed surface of the plug 19 upon assembly of the tool.

Assembly of the head 10 and the handle 11, is made on a multi-press using about 8000 pounds pressure. The extreme pressure to which the tool is subjected in assembly insures a strong compressive fit between the tapered shank portion 15 of the handle 11 and the circumferentially concave walls of the socket recess 14 without, however, causing the handle, as its tip portion 15' to touch the end wall 10'. Thus the uncured and liquid bonding compound 21 is free to flow throughout the uninterrupted spaces surrounding the reduced tip portion 15' and the inwardly disposed end surface of the circular plug 19.

The escape of air from the socket recess 14, as well, as any excess of bonding material 21 not needed to fill the spaced surrounding the reduced portion 15', is provided for by the passage 20 in the circular plug 19. Air pockets are thereby eliminated and pressure which might otherwise dislodge the plug 19 is relieved.

It will be noted that although the handle 11, at its shank portion 15, is held in highly compressive engagement with the head 10 by the socket recess 14 therein, the tip portion 15', through the action of the relief passage 20 in the plug 19, does not exert pressure against the bonding material 21 but is rather suspended therein. The hardening of the bonding material 21 and its adhesion to the wall surfaces of the socket recess 14, the outer circumferential surfaces of the tip portion 15', and the exposed end surface of the plug 19 compressively fitted therein, produces a uniting and integrating of handle and head, independent of the compressive and reactive forces of the relatively tapered and interfitted portions thereof. The resulting combination of compressive reactive gripping and unrestrained bonding produces an attachment of great strength and resistance to loosening.

Referring now to FIGS. 7, 8, and 9, I show another form of my invention which eliminates the use of the plug 19, but is otherwise composed of parts substantially identical with those shown in my first embodiment. Here, again, the problem is the rigid and permanent attachment of a thin-walled tubular metallic handle to the head of a tool such as a hammer, wherein the use of pins or rivets is eliminated, while yet retaining all of the characteristics of strength and resistance to sudden stresses so necessary in the construction of such a tool.

At 110, I show a head, similar to the head 10 of my first embodiment, having a socket recess 114 penetrating into the head and disposed at substantially right angles to the direction of striking and terminating at an end wall 110' at its innermost depth. The socket recess 114 is circular in cross-section, the concave wall surfaces of said socket recess converging slightly as they extend from the outer surface of the head 110 inwardly to the end wall 110', as do the wall surfaces of the socket recess 14 in the head 10 of my first embodiment.

The handle 111, a part of which is shown sectionally and on an enlarged scale in FIG. 8, is substantially identical as to shape and proportion with the handle 11 shown in FIGS. 1 and 2 and further detailed in FIGS. 3 to 6, one end being provided with a slightly tapered, cross-sectionally circular shank portion 115. The shank portion 115 is of such size and taper as to be subject to

press-fitting into the socket recess 114, and there to be compressively held in a rigid and permanent attachment.

The tapered shank portion 115 is provided at its extreme end with a circumferentially reduced tip portion 115' corresponding to the reduced tip portion 15' on the shank portion 15 of the first form of my invention.

Referring now to the method of assembly, the circumferential surfaces of the tip portion 115' are first roughened, as by grinding or sanding to insure good bonding surfaces. A decorative ferrule 122, if used, is then telescoped over the shank portion 115 and positioned upon the handle 111 adjacent said shank portion, as shown in FIGS. 8 and 9. With the head 110 held or placed in an inverted position as shown in FIG. 9, or in an upright position as shown in FIG. 8, there is poured or inserted into it a quantity of adhesive bonding material 121 in an uncured or liquid state, such quantity of bonding material being sufficient to surround and fill the tip portion 115' when the handle 111 and the head 110 have been compressively assembled, as shown in FIG. 8.

Assembly of the head 110 and the handle 111 is made on a multi-press using about 8000 pounds pressure.

As at 15' of the handle 11 of my first embodiment disclosed herein, the reduced tip portion 115' does not touch the wall 110' or the interior wall surfaces of the socket recess 114, thus allowing uninterrupted flow of the liquid bonding material around and within the tip portion 115'.

In curing, the bonding material 121 becomes a rigid mass, firmly cohering with the inner and outer wall surfaces of the reduced tip portion 115', the concave wall surfaces of the socket recess 114 and the inwardly disposed surface of the wall 110'. With the tip portion 115' thus filled and surrounded with the adhesive bonding material 121, the handle 111 is thus unrestrainedly and securely united to the head 110 of the tool.

As in the first embodiment of my invention, the uniting and integrating of the handle 111 and the head 110 bonding is independent of the compressive and reactive forces of the relatively tapered and interfitted portions 115 and 114 thereof.

Although I have described my invention in connection with preferred embodiments thereof, I am aware that numerous and extensive departures may be made therefrom, such as size and dimension, without however departing from the spirit of my invention and the scope of the appended claims.

What I claim is:

1. A striking hand tool of the general class described comprising a metal head having a foremost striking surface and a medially disposed imperforate eye portion and a thin-walled tubular metallic handle, the eye portion of said head providing a socket recess into which an end section of the length of said handle is projected, said handle end section having an endmost tip portion and a shank portion, said shank portion having longitudinally extending outer surface portions, said socket recess having longitudinally extending inner wall surface portions, a recess mouth, a socket end wall, said socket inner wall surfaces formed substantially complementary to the outer surface portions of said shank portion, the said handle being telescoped into said head socket recess and compressively fitted within the recited inner wall surface portions of said socket recess, and said tip portion of said handle end section being laterally interspaced from the inner wall surface portions of said socket recess, and adhesive bonding material filling such interspace.

2. The striking hand tool substantially as set forth in claim 1, characterized by the recited compressively fitted portions of said socket recess and said shank portion being circular on every horizontal line of cross-section.

3. The striking hand tool substantially as set forth in claim 1, characterized by a plug, said plug being disposed within the recited tip portion of the handle and being tightly interfitted therewith, said plug having a restricted passage longitudinally extending therethrough to provide passage means between said recess end wall and the interior of the recited end section of said handle.

4. The striking hand tool substantially as set forth in claim 1, characterized by the recited compressively fitted portions of said socket recess and said shank portion being circular on every horizontal line of cross-section, a circular plug, said plug being disposed within the recited tip portion of the handle and being tightly interfitted therewith, said plug having a restricted passage for fluid material between said recess end wall and the interior of the recited end section of said handle.

5. A striking hand tool of the general class described comprising a metal head having a foremost striking surface and a medially disposed imperforate eye portion and a thin-walled tubular metallic handle, the eye portion of said head having a socket recess into which an end shank portion of said handle is projected, said socket having longitudinally extending inner wall surface portions, a recess mouth, and a socket recess end wall, said shank portion having longitudinally extending outer surface portions, said outer surface portions of said shank portion substantially complementarily interfitting said inner wall surface portions of the socket recess, said shank portion being telescoped into said head socket recess and effecting compressive press fitting of said shank portion within the recited inner wall surface portions of said socket recess, said socket recess end wall laterally interspaced from the end shank portion of the handle, and, adhesive bonding material disposed between said end wall and inner wall surface portions and filling such interspace.

6. The striking hand tool substantially as set forth in claim 5, characterized by the recited shank portion and socket recess being circular on every transverse line of cross-section.

7. The striking hand tool substantially as set forth in claim 5, characterized by a plug, said plug being disposed within the recited shank portion and being tightly interfitted therewith, said plug having a restricted passage therethrough extending between said recess end wall and the interior of the recited thin walled tubular metallic handle.

8. The striking hand tool substantially as set forth in claim 5, characterized by the recited shank portion and socket recess being circular on every transverse line of cross-section, a circular plug, said plug being disposed within the recited shank portion of the handle and being tightly interfitted therewith, said plug having a restricted passage therethrough extending between said recess end wall and the interior of the recited thin-walled tubular metallic handle.

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CERTIFICATE OF CORRECTION

Patent No. 2,994,353 August 1, 1961

George W. Yearley

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 22, for "as" read -- at --; line 27, after "well" strike out the comma; same column 4, line 29, for "spaced" read -- spaces --.

Signed and sealed this 5th day of December 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents

USCOMM-DC