March 9, 1965 A. S. E. REUTERFORS 3,172,708

HAMMER WITH HANDLE FASTENING MEANS

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Fig. 1.

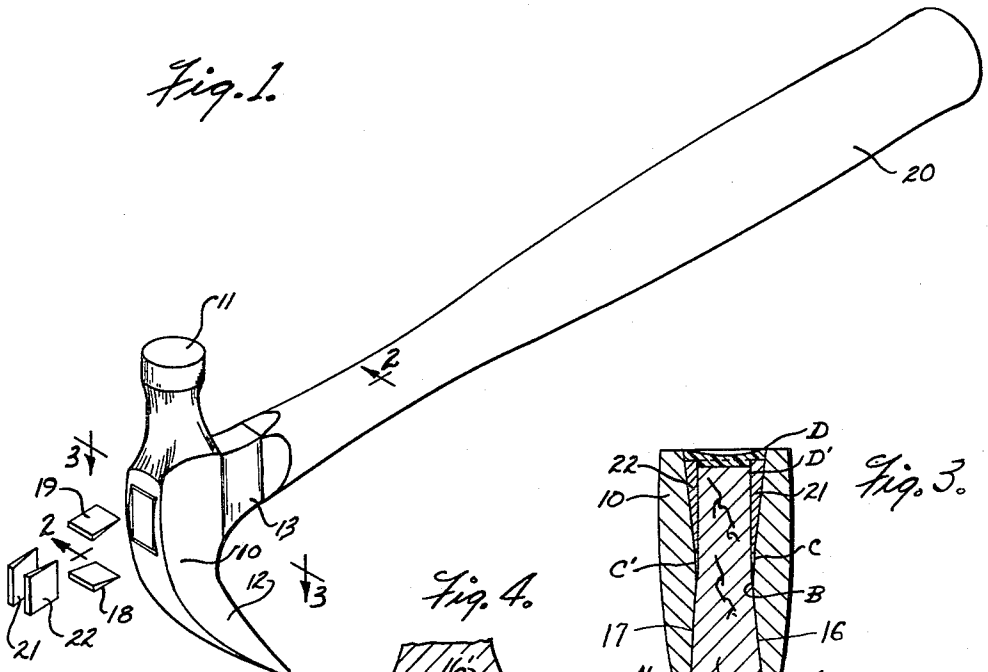



Fig. 3.




Fig. 4.

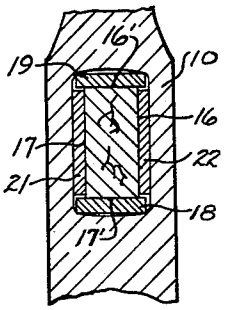






Fig. 2.

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# HAMMER WITH HANDLE FASTENING MEANS

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This invention relates to the the improvements in handle connections for percussive tools, of which hammers, hatchets and axes are suitable examples.

While metal handles of various kinds have been employed on tools of this general character, wooden handles are favored by some users of these tools, and this invention is directed to the improvements in the use of wood handles. The art is replete with many different examples of methods and means for securing wood handles to percussive tools.

It is a simple matter to taper the handle and taper the eye to provide a tight wedging fit at the entrance of the eye, but problems arise at the other end of the eye in the tool.

Brief mention may be made of the use of wedges, usually of metal, which are driven into the exposed forward end of the handle in such a tool as a hammer, for the purpose of expanding that end to cause it to be wedged tightly in the forward portion of the eye. It is apparent that, while such wedges initially do expand the exposed forward end of the handle and provide a tight fit or locking fit, they split the fiber structure longitudinally, thus weakening the wood.

Also, due to repeated expansion and contraction of the wood under changing humidity conditions and due to the effects of shock and stresses occurring between the handle and the head of the percussive tool, the tightness of the fit of the handle in the hammer head eye diminishes and requires readjustments and often eventual replacement of the original handle by a new handle.

One of the prior attempts to secure a wooden handle to the head of a percussive tool without the use of wedges, has involved the use of a resilient adhesive, such as a plastic resin adhesive which filled the cavity between the handle and the eye of the head. A thick layer of adhesive is required to fill the space between the handle and the head and only partial success has attended these efforts. The resilient adhesive does not have the same vibration absorbing properties as the wood handle and when the hammer handle is in part insulated from the head of the hammer by a thick layer of adhesive, vibrations set up in the hammer head during use of the tool are not sufficiently dampened by absorption in the wood handle. The use of the very thick layer of adhesive to fill the space between the head and handle is also undesirable for other reasons. Most adhesives provide maximum bonding strength when used in very thin layers and become less effective when thicker layers thereof are used. Further, thin layers of adhesive are generally more resilient than thick layers and can more readily withstand the pounding and vibration that occurs in use of percussive tools. Moreover, adhesives of the plastic resin type have a high coefficient of thermal expansion and contraction and, when thick layers are used, there is a substantial expansion and contraction with changes in temperature. A large amount of expansion of the plastic resin tends to collapse the wood fibers in the handle and causes loosening of the head.

However, when such resin adhesive material is utilized in this invention, it is applied to the various surfaces only in very thin layers just sufficient to perform the adhesive function and is not used as a space filler. Such a layer serving only as adhesive is not compressible to any substantial or effective degree. It is less affected by shocks,



stresses and thermal changes than would a substantially thicker layer of the same resin material. It serves, therefore, only as an adhesive, and the shocks and stresses occurring during use of the percussive tool are readily transmitted between the metallic head and the wooden wedges and wooden handle. Moreover, when used in a thin layer, the adhesive achieves its maximum bonding strength and avoids excessive thermal expansion and contraction.

The general object of the invention is to provide improvements in the securing of a wood handle to a percussive tool such as a hammer, hatchet, axe or other tools for which wood handles would be suitable.

A further object of the invention is to provide a percussive tool having a handle receiving eye designed for quick and efficient mounting of a handle therein, providing means for wedging the handle in the eye in such manner as actually strengthens rather than weakens the handle.

Another object of the invention is to provide means for mounting a wood handle in the metallic head of a percussive tool without employing elements which require insertion into the handle.

Another object of the invention is to provide means for mounting a wood handle in the metallic head of a percussive tool in such manner that, when the handle needs replacement, the securing elements and adhesives may easily be removed from the eye of the tool head.

Other objects or advantages of the invention will be mentioned specifically hereinafter or will become apparent in the following specification:

Referring now to the drawing,

FIG. 1 is a perspective view of a claw hammer with a wood handle mounted therein in accordance with this invention.

FIG. 2 is a vertical central sectional view through a portion of the hammer head showing the mounting of the head.

FIG. 3 is a sectional view on line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 2.

For illustrating the invention, there is shown a claw hammer having a body **10**, a poll **11**, a conventional claw **12** at the other end of the body, a boss **13** extending laterally from the body and a handle receiving eye extending through the body of the hammer head and through boss **13**. The entrance end of the eye is designated as **14**, whereas the exit or locking end of the eye is designated as **15**. As indicated in FIG. 2 and FIG. 3, the cross sectional area of the eye, taken at any plane perpendicular to the axis of the handle or the axis of the eye is generally rectangular, with wide opposite walls generally paralleling the lengthwise axis of the body **10** and relatively narrower edge walls extending transverse to the lengthwise axis of the body. However, the cross-sectional area of the eye varies throughout the length of the eye. From zone B to A at the entrance end of the eye, the walls have an expanding taper, provided so that the wood handle may be likewise shaped and tapered for a drive fit of the handle during assembly of the handle on the head. From zone B to C, however, the vertical cross sectional area of the eye may be uniform, as shown in FIGS. 2 and 3, which assures ample room for the inner extremities of the wedges hereinafter described. From zone C to D, however, the four walls of the eye have an expanding taper toward the exit or locking end **15** of the eye. For reasons that will become apparent as the description proceeds, the taper from C to D is relatively long and the zone B–C of minimum cross-section in the eye is short and preferably located approximately midway between the ends of the eye.

Referring now to FIGS. 2, 3 and 4, the portion of the handle **20** that extends into the eye is made generally rec-

tangular in cross-section and includes wide generally flat side walls 16 and 17 and relatively narrower edge walls 16' and 17'. The portion of the handle from A' to C', which is received in the entrance end of the eye, is tapered generally complementary to the entrance end 14 of the eye to form a snug fit with the eye in the zone A to B. While the side and edge walls of the handle portion in the eye must have a decreasing taper in the zone from A' to C', as shown in FIGS. 2 and 3, it is not desirable to continue this same taper to the extreme forward end of this handle portion. It is preferred to form the side and edge walls of this handle portion extending from C' to D' with substantially less taper than the portion A' to C', whereby the side and edge walls extend more nearly parallel to each other. As shown, the side walls 16 and 17 from C' to D' actually have no taper. When formed in the preferred manner, this portion of the handle will be of generally uniform dimensions from C' to D', whereby the forwardmost end of the handle at D' will not be unnecessarily narrow in cross-section.

The handle is pressed into the eye in the head until the handle has a tight fit with the entrance end of the eye. When the eye and handle are both shaped, as shown and described above, the side walls and edge walls of the eye in the zone from C to D, diverge relative to the side and edge walls of the handle from C' to D', and form a tapered cavity around the periphery of the handle extending from C' to D'. The taper on the exit end of the eye from C to D is made sufficient to receive a wedge of substantial thickness at each side of the cavity and, preferably, the handle and eye are spaced in the zone D a distance of the order of 3/32" to 1/8". As previously noted, the taper at the locking end of the eye preferably extends to a point substantially midway between the ends of the eye to enable use of long wedges with a shallow taper.

An adhesive suitable for bonding wood to wood and wood to metal is used for bonding the wedges and handle together and to the eye. The entering end of the handle can be coated with adhesive prior to assembly into the eye, if desired to bond the handle to the entrance end of the eye and to seal the entrance end of the handle. Adhesive is also preferably introduced into the cavity at the exit end of the eye after assembly of the handle, to coat the end of the handle and the walls of the cavity.

A plurality of preformed wedges are then inserted into the cavity alongside the end of the handle. The wedges are advantageously formed of hardwood or similar fibrous material having substantially the same vibration damping characteristics as the handle. Four wedges designated 18, 19, 21 and 22, one for each side of the cavity, are provided and the wedges are preformed with a taper generally similar to the taper of the cavity between the eye and handle in the zone C to D. When assembling the head on the handle, the head and handle are clamped in a suitable fixture jig to assure proper orientation of the head on the handle, and the tool is held by the fixture during insertion of the wedges. The wedges are pressed into the cavity at each side of the handle into tight wedging fit with the handle and eye. If there are minor variations in the shape of the locking end 15 of the eye or in the shape of the end of the handle, the width of the cavity will not always be the same at each side of the cavity. However, since the head and handle are maintained in proper relation to each other by the aforementioned fixture during assembly of the wedges, the several wedges can be individually driven inwardly a greater or lesser distance as required to substantially fill the spaces at the respective sides of the cavity. The wedges then function to maintain the head in proper relation to the handle during setting or curing of the adhesive and enable the tool to be immediately removed from the assembling fixture without having to wait for the adhesive to set. The wooden wedges will compress somewhat during insertion to maintain a tight fit and to conform to irregularities in shape or form of the eye and handle. The wedges press most of the adhesive out of the cavity and leave only a thin film between the wedges and the handle and between the wedges and eye. The excess adhesive can be allowed to remain and solidify at the exit end of the eye, and additional adhesive can be applied if necessary to form a sealing layer 23 on the end of the handle to inhibit entrance of moisture into the handle and wedges.

The wedges are thus firmly bonded to the handle and form a generally hour-glass configuration therewith that substantially fills the eye of the head to firmly retain the head on the handle. The wooden wedges have vibration dampening characteristics substantially the same as the rest of the wooden handle and avoid damaging vibration of the head and claws during use of the tool. Moreover, if it becomes necessary to replace the handle due to breakage, it is much easier to chip out the wood parts from the eye and then scrape the thin layer of resin adhesive, than it is to remove a thick layer of resin adhesive.

The adhesive used for bonding the wedges to the head and handle should be of a type that will form a strong bond with both wood and metal. There are commercially available plastic resin adhesives suitable for this purpose, if used in the thin layers permitted by the disclosed construction. The plastic resin adhesives have high bond strengths to both wood and metal and are well adapted for use in this invention. A plastic resin adhesive that is commonly used, is produced by reacting epichlorohydrin with a phenol known as bisphenol A, the resulting product generally being referred to as epichlorohydrin bisphenol. The plastic resin adhesives are prepared for use by mixture with a suitable curing agent which converts the resins to chemically and mechanically strong thermosetting polymers. The various curing agents and various modifiers sutiable for use with such resins are well known and available from the manufacturers of such resins. Further detailed description of the composition and use of the plastic resin adhesives is accordingly deemed unnecessary.

It should be understood that while this invention is herein described in considerable detail, the invention is not limited thereto, but embraces such modifications and variations as fall within the scope of the claims appended hereto.

I claim:

1. A percussive tool comprising a metallic head having a handle receiving eye extending therethrough and a wooden handle portion positioned therein, said eye having an entrance end and a locking end, said eye having a substantially rectangular cross sectional area in all parallel planes transversely perpendicular to the axis of said handle portion between said eye ends, the minimum cross sectional area of the eye being at an intermediate zone between said eye ends, all four walls of the eye having an expanding taper from said intermediate zone toward each of said two ends, said handle portion being tapered in a first part to provide a snug drive fit with the tapered eye walls extending from said entrance end to said zone, a second part of said handle portion having a substantially equal transverse rectangular cross section from its position at said zone forwardly to its front terminus, said front terminus being disposed adjacent said locking end, four separate wooden tapered wedges snugly fitted between the four walls of the eye forwardly of said zone and the adjacent surfaces of said second handle portion, all surfaces of said handle portion and said eye and all surfaces of said wedges being coated with a plastic resin adhesive, and a moisture resistant seal closing said locking eye.

2. A percussive tool comprising a metallic head having a handle receiving eye extending therethrough and a wooden handle portion positioned therein, said eye having an entrance end and a locking end, said eye having a minimum cross sectional area transversely perpendicular to the axis of said handle portion at an intermediate zone between the eye ends, the inner walls of the eye between

said zone and the entrance end and a first part of said handle portion positioned within said eye between said zone and the entrance end having substantially identical cross sectional areas at all parallel planes transversely perpendicular to the axis of said handle portion, the eye between said zone and said locking end having a substantially rectangular cross sectional area in all parallel planes transversely perpendicular to the axis of said handle portion, all four walls of the eye between said zone and said locking end having an expanding taper, a second part of the handle portion positioned between said zone and said locking end having a substantially rectangular cross section in all parallel planes transversely perpendicular to its axis, said handle section of said second part being less in each dimension than the cross sectional area of the eye at the same planes, and a plurality of wooden tapered wedges snugly fitted in between the four walls of the eye forwardly of said intermediate zone and the adjacent surfaces of said second handle part, substantially all surfaces of the walls of the eye and of said wood handle portion and the surfaces of the wooden wedges being coated with a plastic resin adhesive, and moisture resistant means sealing the locking eye outside of said handle portion.

3. A percussive tool comprising a wood handle and a metallic head having a handle-receiving eye extending therethrough, the eye being tapered expandingly from its middle zone to its entrance end and being tapered expandingly from the middle zone to its locking end, the last said taper being provided by four flat walls whose cross section transversely of the eye axis is generally rectangular, the wood handle having an outside taper



on one portion within the eye adapted for snug fitting in said first taper and having a second portion within the eye provided with four flat surfaces spaced inwardly from the second taper, the transverse cross section of which surfaces is rectangular, and four flat tapered wood wedges snugly fitted between said surfaces and said flat walls, said handle portions, wedges and eye interior tapers being adhesively coated prior to assembly.

4. A percussive tool comprising a wood handle and a metallic head having a handle receiving eye extending therethrough, the eye being tapered expandingly from its middle zone to its entrance end and being tapered expandingly from the middle zone to its locking end, the last said taper being provided by four flat walls whose cross section transversely of the eye axis is generally rectangular, the wood handle having an outside taper on one portion within the eye adapted for snug fitting in said first taper and having a second portion within the eye provided with four flat surfaces spaced inwardly from the second taper, the transverse cross section of which surfaces is rectangular, and four flat tapered wood wedges snugly fitted between said surfaces and said flat walls, said handle portions, wedges and eye interior tapers being adhesively coated prior to assembly, said wedges substantially filling the space between said surfaces and walls from said zone to said locking end.

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