Dec. 15, 1959 C. P. SAYLOR ET AL 2,917,349

TOOL-HANDLE CONNECTION WITH DAMPED RESILIENT BOND

Filed Dec. 14, 1953

FIG. 2.

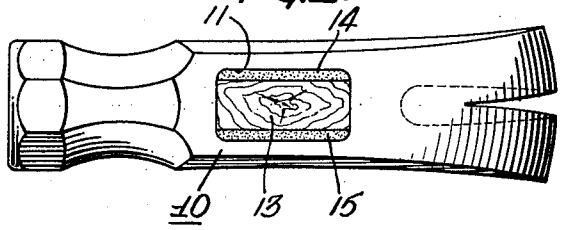


FIG. 1.

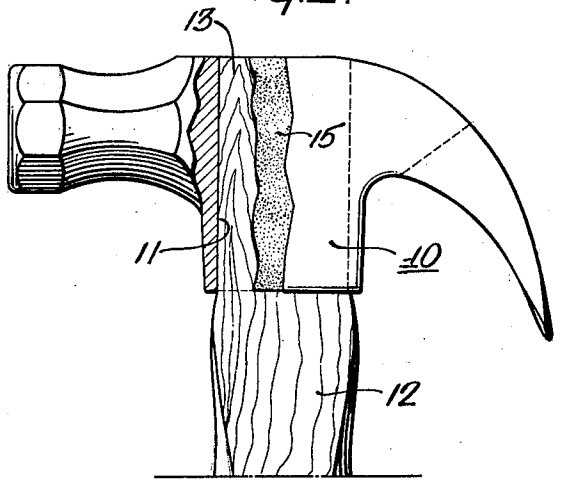


FIG. 3.

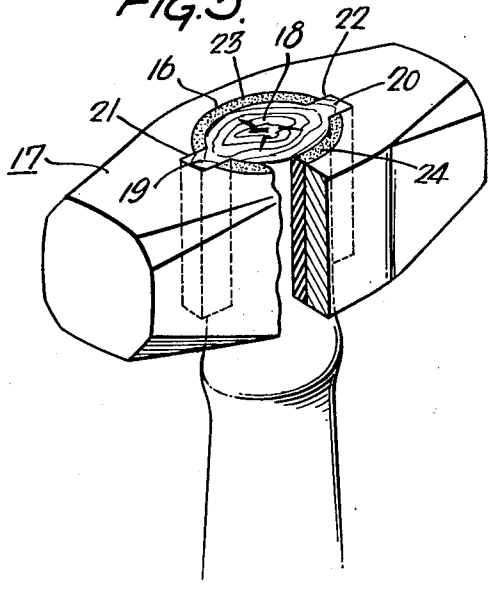
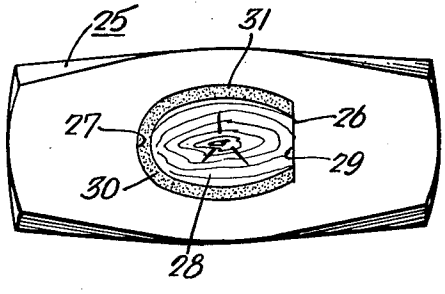


FIG. 4.



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TOOL-HANDLE CONNECTION WITH DAMPED RESILIENT BOND

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4 Claims. (Cl. 306—20)

This invention relates generally to all types and kinds of tools comprising a work-performing metallic part or member and a non-metallic handle secured thereto.

The principal object of the invention is to provide an improved tool of this general character as hereinafter described.

The handles of many types of tool are commonly made of wood or other non-metallic substance such as the organic plastics. The latter may be reinforced, as with laminated fiber glass. The attachment of the handle to the metallic part of the tool is mechanical, depending upon compression of the substance of which the handle is composed. Wedges, driven tapered shafts, screws which serve as wedges, and other devices are employed to enhance the compression. This compression causes friction. So long as the friction remains unabated, the metallic part of the tool and the handle are likely to remain in firm union. It is an almost universal experience, however, that with time, use, and exposure the parts become loosened and eventually separate.

In U.S. Patent No. 2,656,225, issued to one of the present applicants, there is disclosed and claimed a structure which overcomes the aforementioned objection, which structure comprises an annular layer of normally-unstressed deformable shock-absorbent rubber-like material interposed between the metallic part of the tool and the associated handle portion and directly bonded thereto. The said material deforms somewhat under the stresses and changes of size of the handle, and it transmits and distributes forces of tension, compression, torsion and shear between the handle and the work-performing metallic part of the tool. A structure of this character has been found to be very effective in preventing loosening and separation of the tool parts even under severe use.

Although the above-mentioned structure has solved the problem of loosening and separation of the tool parts, it makes possible certain instances of extreme use in which another form of failure can develop in cases where very severe activations of the work-performing metallic part follow in such rapid succession that ringing vibration of said part occurs. The superposition of the shock waves from successive activations or strokes causes stresses, which can even bring about fracture of the metal. There have been instances, for example, in which the claws of a hammer have flown off or the head has cracked adjacent to the opening provided for the handle.

To explain this further, a piece of hard metal if it is loosely suspended will, when struck, ring for a long time. Only the transfer of energy to the support, or to the air with consequent dissipation as sound, or the inelastic absorption of vibration by the metal with production of heat, can bring an end to the vibration. A new stroke, while the vibration is still at high intensity, can cause unpredictable but large stresses at many places in the metal. It is for this reason that in some instances a tool embodying the structure of the aforementioned patent will develop destructive stresses in the metal part. This

is particularly true in the case of percussive tools such as hammers, hatchets, axes, picks, etc.

In accordance with the present invention, the aforementioned objection is overcome by providing partial direct engagement between the work-performing metal member and the associated handle portion of a tool, while at the same time providing deformable shock-absorbent rubber-like material in one or more spaces between said parts and directly bonded thereto. We have discovered that the advantages of the structure disclosed in the aforementioned patent can be had without recourse to a complete annulus of rubber-like material, and that partial direct engagement between the metal member and the associated handle portion of a tool effects damping of deleterious vibrations of the head member so as to preclude production of destructive stresses therein.

The invention may be fully understood from the following detailed description with reference to the accompanying drawing wherein the invention is illustrated as applied to hammer-type tools, although it is applicable to any tool having a metallic work-performing member and a non-metallic handle.

In the drawing,

Fig. 1 is an elevational view of a portion of a hammer embodying one form of the invention, with a portion of the head broken away for the purpose of illustration;

Fig. 2 is a plan view of the hammer;

Fig. 3 is a perspective view of a portion of a hammer embodying another form of the invention, with a portion of the head broken away for the purpose of illustration; and

Fig. 4 is a plan view of a hammer embodying still another form of the invention.

Referring more particularly to the drawing, in the embodiment of Figs. 1 and 2, the head member **10** of the illustrated hammer has an opening **11** of rectangular cross section; and the handle **12** has a portion **13** inserted in said opening, the portion **13** also being of rectangular cross section but being narrower in width than the opening **11** to provide opposed spaces in which there are layers **14** and **15** of the rubber-like material. These layers are bonded to the adjacent surfaces of the head member and the handle portion in accordance with the teaching of the aforementioned patent. The other two opposed surfaces of the handle portion **13** are in direct engagement with the head member **10**.

In an arrangement such as shown in Figs. 1 and 2, the surfaces of direct engagement and the spaces occupied by the rubber-like material may be relatively reversed, or any other modification may be employed in which there is partial direct engagement between the head member and the handle.

In Fig. 3 the opening **16** of the head member **17** is generally rounded over the greater part of its cross-section, and the handle portion **18** is also generally rounded over the greater part of its cross section and somewhat smaller than the opening **16**. Further, the opening and the handle portion are formed to provide opposed interfitting areas of direct engagement between the head member and the handle portion. In the specific device illustrated, the handle portion **18** has opposed ribs or projections **19** and **20** which seat in recesses **21** and **22** of the head member. This arrangement facilitates assembly and effectively centers the handle portion with respect to the generally circular opening of the head member. Opposed layers **23** and **24** of the rubber-like material are provided in the opposed arcuate spaces between the head member and the handle portion, and these layers are bonded to the adjacent surfaces in accordance with the teaching of the aforementioned patent.

In the arrangement of Fig. 3, the interengaging projections and recesses may be disposed in positions other

than those shown, for example, they may be shifted through 90° from the positions shown, and the rubber-like layers may be disposed accordingly. Moreover, the number of interengaged projections and recesses may be varied.

In the embodiment of Fig. 4, the opening in the head member **25** is defined by a flat surface **26** and a curved surface **27**. The handle portion **28** has a flat surface **29** directly engaging the flat surface **26** and a curved surface **30** in spaced relation to the curved surface **27**. A curved layer **31** of the rubber-like material is positioned in the space between the two curved surfaces and is directly bonded to those surfaces in accordance with the teaching of the aforementioned patent.

Here again the illustrated arrangement may be modified to shift the positions of the directly engaged surfaces and the rubber-like material.

In any embodiment of the present invention, such as those illustrated and described, the deformable shock-absorbent rubber-like material transmits forces of tension, compression, torsion and shear between the surfaces to which it is bonded and distributes stresses generally over those surfaces, and the partial direct engagement between the metallic work-performing member and the associated handle portion serves to effect damping of deleterious vibration of the metallic member so as to preclude the production of destructive stresses therein. The rubber-like material serves the purposes for which it is intended according to the teaching of the aforementioned patent, but it tends to effect free or loose suspension of the head member and thus tends to promote resonant vibration of the metallic member. However, the partial direct engagement between the metallic member and the associated handle portion effects damping of any pronounced vibrations occuring in the metallic member and thus prevents production of destructive stresses therein.

It is deemed unnecessary in this application to give specific examples of the rubber-like material or to describe the method of bonding it to the adjacent surfaces, as these are described in detail in the aforementioned patent.

While certain specific embodiments of the invention have been illustrated and described for the purpose of disclosure, it will be apparent that numerous arrangements are possible within the purview of the invention, and the illustrated embodiments are intended only to be exemplary and not to limit the invention.

We claim:

1. A tool comprising a metallic work-performing member having an opening therein, a handle having a non-metallic end portion positioned in said opening, said end portion having at least one area in direct engagement with said member throughout the depth of said opening, and having at least one other area spaced from said member throughout the depth of said opening, and deformable shock-absorbent rubber-like material fully occupying the space between said metallic member and said handle portion and directly bonded to the spaced surfaces thereof to transmit forces of tension, compression, torsion and shear between said surfaces and to distribute stresses generally over said surfaces, the partial direct engagement between said metallic member and said handle portion serving to effect damping of deleterious vibrations of the metallic member so as to preclude the production of destructive stresses therein.

2. A tool comprising a metallic work-performing member having an opening therein, a handle having a non-metallic end portion positioned in said opening, said end portion having two opposed areas in direct engagement with said member throughout the depth of said opening, and having two other opposed areas spaced from said member throughout the depth of said opening, and a layer of deformable shock-absorbent rubber-like material fully occupying each of the opposed spaces and directly bonded to the spaced surfaces of said metallic member and said handle portion to transmit forces of tension, compression, torsion and shear between said surfaces and to distribute stresses generally over said surfaces, the aforementioned direct engagement between said metallic member and said handle portion serving to effect damping of deleterious vibrations of the metallic member so as to preclude the production of destructive stresses therein.

3. A tool according to claim 2, wherein said opening and said handle portion are of rectangular cross-section, and said areas of direct engagement are substantially planar, and each layer of rubber-like material is in the form of a flat sheet.

4. A percussion tool comprising a metallic head having an elongated opening extending therethrough, a handle member having a non-metallic mounting portion positioned in said opening, the confronting surfaces of said head opening and the handle mounting portion being spaced apart along a part of the handle mounting portion extending inwardly therealong from an end of the head opening toward the other end of said head opening, the remainder of said confronting surfaces being in direct contact with each other, and a deformable shock-absorbent rubber-like material substantially fully occupying the space between said head portion and said handle and directly bonded to the spaced surfaces thereof to transmit forces of torsion, compression, tension and shear between said surfaces, and to distribute stresses generally over said surfaces, the direct contact between the remainder of said metallic head portion and said handle serving to effect damping of deleterious vibrations of the metallic head portion to preclude the production of destructive stresses therein.

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