June 13, 1972 W. C. PARKS 3,669,512

IMPACT TOOL AND COMPOUND HANDLE-RETAINING WEDGE THEREFOR

Filed Nov. 18, 1970

FIG. 1

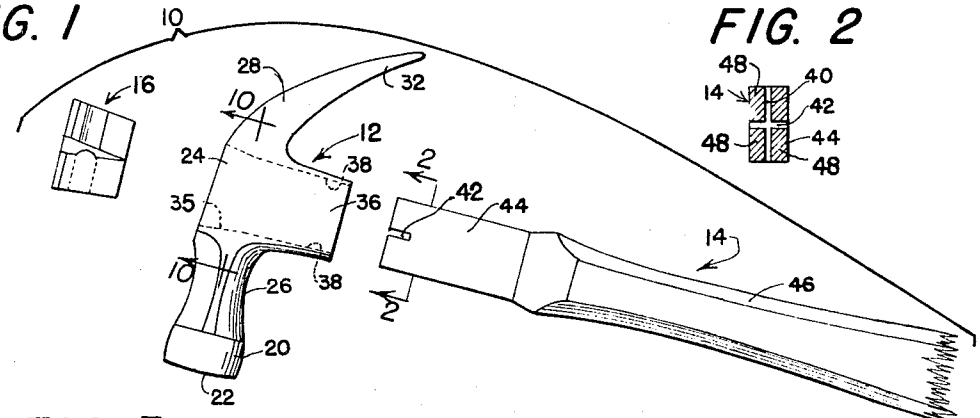


FIG. 2

FIG. 3

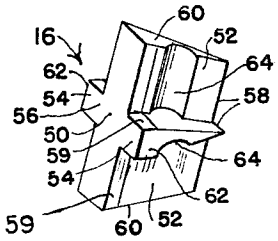


FIG. 4

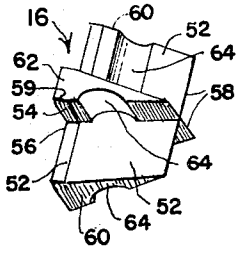


FIG. 10

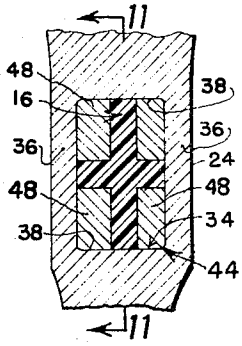


FIG. 5

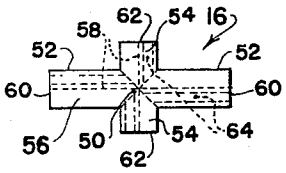


FIG. 7

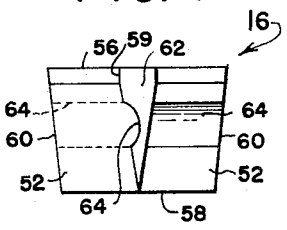


FIG. 9

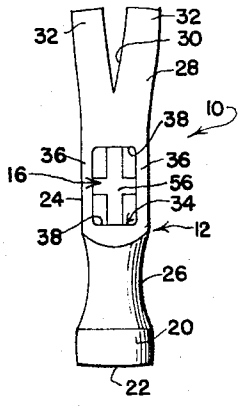


FIG. 6

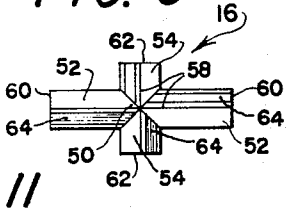


FIG. 8

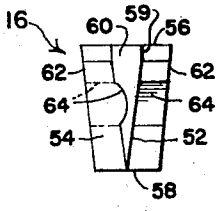
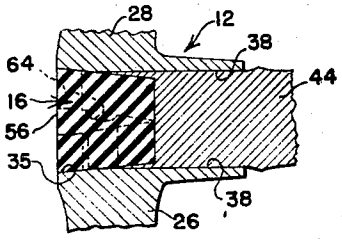


FIG. 11



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3,669,512

IMPACT TOOL AND COMPOUND HANDLE-RETAINING WEDGE THEREFOR

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ABSTRACT OF THE DISCLOSURE

A compound wedge adapted to be pressed into the conformably slotted distal end of a fresh wooden impact tool handle in order to spread such end and compress the wood thereof outwardly against the walls of the eye in the head of the impact tool and thus permanently tighten the handle and head together. The wedge exerts a spreading action in both lateral directions and it is comprised of a resilient compressible plastic material having a modulus of elasticity which substantially matches the shrinkage and expansion factor of the wood which it displaces so that, as the moisture content of the wood evaporates and shrinkage takes place, the restorative property of the wedge compensates for such shrinkage. Conversely, as the shrunken wood absorbs moisture and regains size, the wedge is forcibly contracted. Thus, in any condition of the wood, the handle remains tight. An impact tool embodying such a wedge.

The present invention relates generally to portable impact tools and has particular reference to that class of impact tools which is exemplified by hammers, axes, hatchets, mallets, picks, and the like. More particularly, the invention relates to that type of impact tool which consist of a metallic head to which there is attached a manipulating handle of wood.

The problem of maintaining a wooden handle permanently in tight fitting relationship within the eye in the head of a claw hammer or similar impact tool has long plagued tool manufacturers. Considering, for example, a claw hammer having a hickory handle, it has heretofore been the practice to slot the distal end of the handle and to drive one or more wedges into the slot or slots in order to spread the slot-formed wooden tines apart and compress them against the opposite side walls of the eye in the hammer head. This procedure is not altogether satisfactory inasmuch as, upon drying out of the wood of the handle, shrinkage takes place with the result that the wedge and the adjacent portion of the handle become loose and, consequently, the handle and head are no longer securely maintained in connected relationship. In order to inhibit wedge dislodgment, wedges having serrated flat sides have heretofore been proposed, but the involved improvement is slight inasmuch as looseness of the handle in the head still takes place when usual shrinkage of the wood takes place. This is not surprising when it is considered that hickory, as commonly used for the handles of hammers and other impact tools, has a moisture content on the order of from 8% to 12% at the time of wedge installation. The users of claw hammers and other impact tools, in an effort to alleviate the shortcomings of the manufacturers, frequently augment the wedging action of the original wedge or wedges by driving one or more nails into the eye of the hammer head, or by fashioning makeshift wedges from wooden chips and driving them in place. Nails invariably work loose as further drying of the wood of the handle takes place, while wooden wedges are themselves subject to shrinkage in time. Furthermore, once any looseness, however small, takes place, repeated impact blows by the hammer on the work progressively increases such looseness.

The present invention is designed to overcome the above-noted limitations that are attendant upon the use of conventional wedges in connection with handle-to-head securement and, toward this end, the invention contemplates the provision of a novel impact tool wedge which is formed of a molded thermoplastic material having a modulus of elasticity which substantially matches the dehumidification shrinkage factor of the wood of the handle to the tool, and also matches the expansion factor thereof when water absorption takes place. In order to install the wedge in position within the eye of the head of the tool, the distal end of the handle (which is conformably shaped to the cavity which is presented or formed by the eye) is slotted two ways, i.e., by intersecting slots which extend at right angles to each other and the wedge is of a compound nature and is conformably X-shaped so that it will fit into the intersecting slots. The radial wedge arms are individually divergent from thin forward edges to relatively thick rear edges so that when wedge and slot registry is attained and the wedge pressed forwardly into the eye of the head, the four wooden tines which are established by the slotting operation are not only spread radially apart but they also are individually compressed on all four sides. Each wedge arm is formed with a recess in one side thereof and into such recess the opposed inside face of the associated wooden tine projects as the compound wedge is pressed or driven home, thus affording a pronouncedly secure locking action which holds the wedge against dislodgment. By such an arrangement and procedure, as the moisture content of the wood of the handle evaporates and shrinkage takes place, the restorative properties of the plastic material of the wedge maintains the four wooden tines under compression, even after the handle is substantially devoid of moisture. Conversely, when the wood of the handle absorbs moisture as the wood swells and tends to regain its original size, the resilient wedge is compressed. Such alternate plastic and wood displacements serve to maintain the eye of the head completely filled with material under compression. Furthermore, the long and the short transverse dimensions of the wedge match those of the eye so that, regardless of wood shrinkage, the eye remains devoid of cavities and at all times is completely filled to the end that there is no handle looseness.

The provision of a wedge of the character briefly outlined above and possessing the stated advantages constitutes the principal object of the present invention.

Other objects and advantages of the invention, not at this time enumerated, will readily suggest themselves as the nature of the invention is better understood by a reading of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the claims at the conclusion hereof.

In the accompanying single sheet of drawings forming a part of this specification, one illustrative embodiment of the invention is shown.

In these drawings:

FIG. 1 is an exploded side elevational view of a carpenter's claw hammer embodying the present invention and showing the hammer head, handle and the novel wedge aligned with one another preparatory to pressing the handle and wedge together within the eye of the hammer head;

FIG. 2 is a transverse section on the line 2—2 of FIG. 1;

FIG. 3 is a top perspective view of the wedge;

FIG. 4 is a bottom perspective view of the wedge;

FIG. 5 is a top plan view of the wedge;

FIG. 6 is a bottom plan view of the wedge;

FIG. 7 is a side elevational view of the wedge;

FIG. 8 is an end elevational view of the wedge;

FIG. 9 is a front end view of the assembled hammer of FIG. 1;

FIG. 10 is an enlarged sectional view taken transversely through the assembled hammer in the eye section of the handle and hammer as represented by the line 10—10 of FIG. 1; and

FIG. 11 is an enlarged sectional view taken on the line 11—11 of FIG. 10.

Referring now to the drawings in detail and in particular to FIGS. 1 and 2, a carpenter's claw hammer which, except for the incorporation therein of the wedge of the present invention, is of conventional construction, is designated in its entirety by the reference numeral **10** and consists of a steel head **12**, a wooden handle **14**, and a wedge **16**. The wedge **16** constitutes the principal feature of the present invention and is illustrated in detail in FIGS. 3 to **8**, inclusive. Although a carpenter's claw hammer has been selected as an exemplary impact tool to which the handle and wedge may be applied in accordance with the principles of the present invention, it should be distinctly understood that the handle and wedge may be associated with a wide variety of impact tools as, for example, an axe, adz, hatchet, sledge, mallet, or the like. Irrespective, however, of the particular use to which the invention may be put, the essential features thereof are at all times preserved.

The illustrated hammer head **12** is conventional and includes an impact head proper **20** having a circular impact face **22**. The head proper **20** is connected to one side of the medial body portion **24** by a constricted portion **26** which may, if desired, be polygonal in cross section. The other side of the body portion **24** of the head **12** is connected to a claw portion **28**, the latter being bifurcated as at **30** (see FIG. 9) in order to provide the usual diverging nail-removing claws **32**. The medial body portion **24** is formed with a central opening having a straight-sided section **34** and a slightly tapered rim section **35**, the opening extending completely through the body portion and establishing a pair of relatively thin side walls **36** and end walls **38**. This generally rectangular central opening **34** is commonly referred to as the "eye" of the hammer head and it will be referred to as such throughout the remainder of this specification and in the appended claims.

Except for the provision of a pair of wedge-receiving slots **40** and **42** (see FIG. 2) which are formed in its distal end region, the handle **14** is conventional and, for purposes of discussion herein, it is stated to be formed of a good grade of hickory. Said handle **14** is provided with a rectangular eye section **44** and a hand grip section **46**. The two slots **40** and **42** are formed in the free end part of the eye section **44** of the handle **14** and intersect each other. The slot **40** extends across the long dimension of the eye section **44** and the slot **42** extends across the short dimension thereof, the two slots thus defining four parallel tines **48** at the distal end of the handle (see FIG. 10). The depth of the slots **40** and **42** is preferably somewhat less than the over-all length or longitudinal extent of the wedge **16** for purposes that will be made clear presently.

Considering now the shape characteristics of the wedge **16**, and referring particularly to FIGS. 3 to 8, inclusive, this wedge is formed by an injection molding operation from a particular thermoplastic material and it consists of a central axial hub portion **50** from which there projects radially outwardly in four directions a series of wedge arms. The latter consists of two aligned long arms **52** and two aligned short arms **54**, the arms **52** and **54** extending at a right angle to each other so that the wedge, considered as a whole, is generally of X-shape in cross section. As best illustrated in FIGS. 7 and 8, each of the four arms is of individual wedge configuration, which is to say that it is substantially of isosceles triangular configuration in vertical section so that the wedge as a whole is provided with a relatively thick X-shaped top face **56** as shown in FIG. 3 and a relatively sharp X-shaped bottom edge **58** as shown in FIG. 4. Small parallel side areas **59** at the large end of each wedge arm may be provided if desired, but these areas detract only slightly from the isosceles aspect of the wedge configuration. The two long arms **52** of the wedge **16** define generally triangular outer end faces **60**, while the two short arms **54** similarly define generally triangular outer end faces **62**. The medial region of each of the four arms is formed with a semi-cylindrical concavity **64**, the axis of which extends horizontally as viewed in FIGS. 7 and 8 with the various concavities facing in a generally counterclockwise direction as viewed in FIG. 6.

The plastic material from which the wedge **16** is formed is of a special nature and possesses physical characteristics which will be described presently after the mode of assembly of the claw hammer **10** has been set forth. In assembling the handle **14**, the hammer head **12**, and the wedge **16** in order to produce the claw hammer **10**, the eye section **44** of the handle **14** is introduced into the eye **34** of the hammer head **12** to the fullest extent of which it is capable of being received and, when thus introduced, it substantially fills the eye **34** except for the voids which exist by reason of the intersecting or crossed slots **40** and **42**. The distal end face of the handle **14** at this time lies substantially in the general plane of the rim of the eye **34** and there is a fairly snug fit between the walls **36** and **38** of the eye and the outer sides of the eye section **44** of the handle **14**.

With the eye section **44** thus inserted into the eye **34**, the assembly is then placed in a press and the wedge **16** is forced into the slots **40** and **42**, the tapered long arms **52** entering the slot **40** and the tapered short arms **54** entering the slot **42**. The handle and wedge are placed under approximately 3,000 pounds compression which is sufficient to drive the wedge to its home position wherein the thick X-shaped top face **56** thereof lies in the general plane of the rim of the eye **34**. Since the over-all extent of the wedge in the longitudinal direction of the hammer handle is less than the depth of the slots **40** and **42** as previously stated, the wedge bottoms in the slots before it reaches its home position and, thereafter, it penetrates the wood of the handle at the bottom of the slots and becomes embedded therein. The wedge thus becomes submerged in the wood to such a depth that the aforementioned concavities **64** become substantially completely filled with wood at the time the wedge reaches its home position, the wood "flowing" into such concavities, so to speak, by reason of its inherent resiliency or elasticity.

It is essential that the wedge **16** be applied to the handle **14** by a pressing operation as described above inasmuch as it has been found that impact blows on the wedge, as is customary when driving conventional wedges in position, are inadequate for the purpose intended. Although the first few blows will be adequate partially to drive the wedge into the slots **40** and **42**, as the wedge begins to tighten beyond a certain limit a "bouncing" action will take place wherein the wedge will pop out of the slots in between blows. After the wedge has thus been driven to its home position, the four concavities **64**, which become interlocked with the wood, serve to retain the wedge in position against dislodgment by reason of certain physical phenomena that will become apparent after the nature of the plastic material of the wedge and the physical nature of the hickory or other wood from which the handle **14** is formed have been set forth.

As previously stated, the wedge **16** is injection-molded from a particular thermoplastic material which is resilient and compressible and which possesses restorative properties whereby it will tend to assume its original state or configuration after deforming pressure is relieved. Furthermore, the modulus of elasticity of the plastic material of the wedge closely matches or is slightly in excess of the shrinkage factor of the wood from which the handle is formed. Thus, during pressing of the wedge **16** into the

slots **40** and **42** under high pressure as previously described, compression resulting in a shrinking of volume of both the wedge and the eye section **44** of the handle **14** takes place while the density of both materials is increased. Specifically, as the wedge is being driven to its home position, inward centripetal force is applied to each tine as adjacent tapered sides of adjacent arms **52** and **54** tend to force the tines toward the corners of the eyes. At the same time, each of the arms **52** and **54** is placed under inward compression. Thus, a reduction in volume of both the four tines and the wedge as a whole takes place and, when the wedge reaches its final home position, shrinkage due to compression of the tines **48** and the wedge **16** has taken place. The eye section **44** of the handle **14** is, therefore, securely wedged in position within the eye **34** of the hammer head **12**.

It is to be noted at this point that, due to the existence of the four concavities **64** in the sides of the arms **52** and **54**, the compressional forces acting on the opposed regions of the tines is not as great as elsewhere so that the wood of the eye section **44** enters these concavities and establishes an interlock between the wedge and the eye section **44** of the handle so that the wedge **16** will not work loose and become dislodged from the eye **34**.

The compressional shrinkage just described in connection with the four tines **48** is not to be confused with the free physical shrinkage or contraction which takes place by reason of drying out of the wood of the handle **14** in point of time after the hammer has been marketed. Conventional hickory handles have a moisture content of approximately from 8% to 12% at the time the wedges are driven, and after a particularly dry period, this moisture content is reduced to as low as 4%, resulting in a very appreciable contraction.

According to the present invention, because of the fact that the modulus of elasticity of the plastic material of the wedge **16** substantially matches the shrinkage and expansion factor of the wooden handle **14** as previously stated, as the various tines **48** contract progressively under the influence of dehumidification thereof, the restorative properties of the then compressed arms **52** and **54** of the wedge **16** cause them to compensate for such wood shrinkage. Conversely, when a dried out handle assimilates moisture and exhibits its own restorative properties, the swelling thereof compresses the plastic material of the wedge and the hammer assembly tends to assume its original condition. Thus, at no time, regardless of the prevailing condition of humidity, will the eye section **44** of the handle become loosened in the eye **34**.

Various thermoplastic materials may be found suitable for use in connection with the injection molding of the wedge **16**, the only criterion being that the modulus of elasticity thereof substantially matches or slightly exceeds both the shrinkage and expansion factors of the hickory or other wood which is employed in the construction of the hammer handle **14** for the purposes herein described. One such material is manufactured and sold by General Electric Company of Schenectady, New York under the trade name "Lexan," although other materials may be found suitable for the purposes intended. An additional advantageous property of the plastic material "Lexan" resides in its toughness and ability to withstand the installation pressure of wedge installation. The material also is shock-resistant and is not affected by impact blows when the hammer is put to use.

It is to be noted from an inspection of FIGS. 7 and 8 that the two outer end faces **60** of the long arms **52** and the two outer end faces **62** of the short arms **54** are inclined toward each other so that the wedge as a whole is tapered in two directions. This tapering of the wedge is intended to match the taper of the walls **36** and **38** of the eye **34** inasmuch as these outer end faces **60** and **62** fit against these walls at the time that the wedge, during pressing thereof into the slots **40** and **42**, reaches its home position.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention. For example, the specific wedge angle of the various arms **52** and **54** illustrated in the drawings measures an angle on the order of 10°. It is obvious that a greater or a lesser wedge angle may be employed if desired, the optimum wedge angle depending upon numerous factors such as the dimensions of the eye **34** and of the eye section **44** of the handle **14**, as well as upon the depth of the slots **40** and **42**. Therefore, only insofar as the invention is particularly pointed out in the accompanying claim is the same to be limited.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. An impact tool comprising a head having a tapered, generally rectangular handle-receiving eye formed therein and presenting four inwardly sloping side wall surfaces, a wooden handle having an eye section at its distal end region and projecting into said eye, and a resilient compressible plastic wedge embedded in said eye section under compression for tightening the later within the eye, said eye section being pre-formed with a pair of intersecting slots which extend inwardly from the distal end face of the handle and define four generally parallel tines, said wedge being generally of X-shape in cross section and presenting a central hub portion and four radial wedge arms each with opposed planar side faces and each of which is of tapered configuration in the longitudinal direction of the wedge and presents a generally trianguar outer end face which bears coextensively against one of said side walls, each wedge arm being formed with a single semi-cylindrical concavity in one slanting side face thereof for interlocking engagement with the compressed wood of the eye section, each pair of adjacent wedge arms, in combination with an adjacent corner region of the eye, serving to displace and compress the wood of one of the tines and thus frictionally maintain the eye section of the handle tightly received within the eye, the modulus of elasticity of the plastic material of the wedge being at least equal to the dehumidification shrinkage and expansion factor of the wood which it displaces whereby, upon shrinkage of said tines due to dehumidification thereof, expansion of the compressed wedge will maintain the tightness of the eye section of the handle within the eye of the head.

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U.S. Cl. X.R.

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