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HAND TOOL

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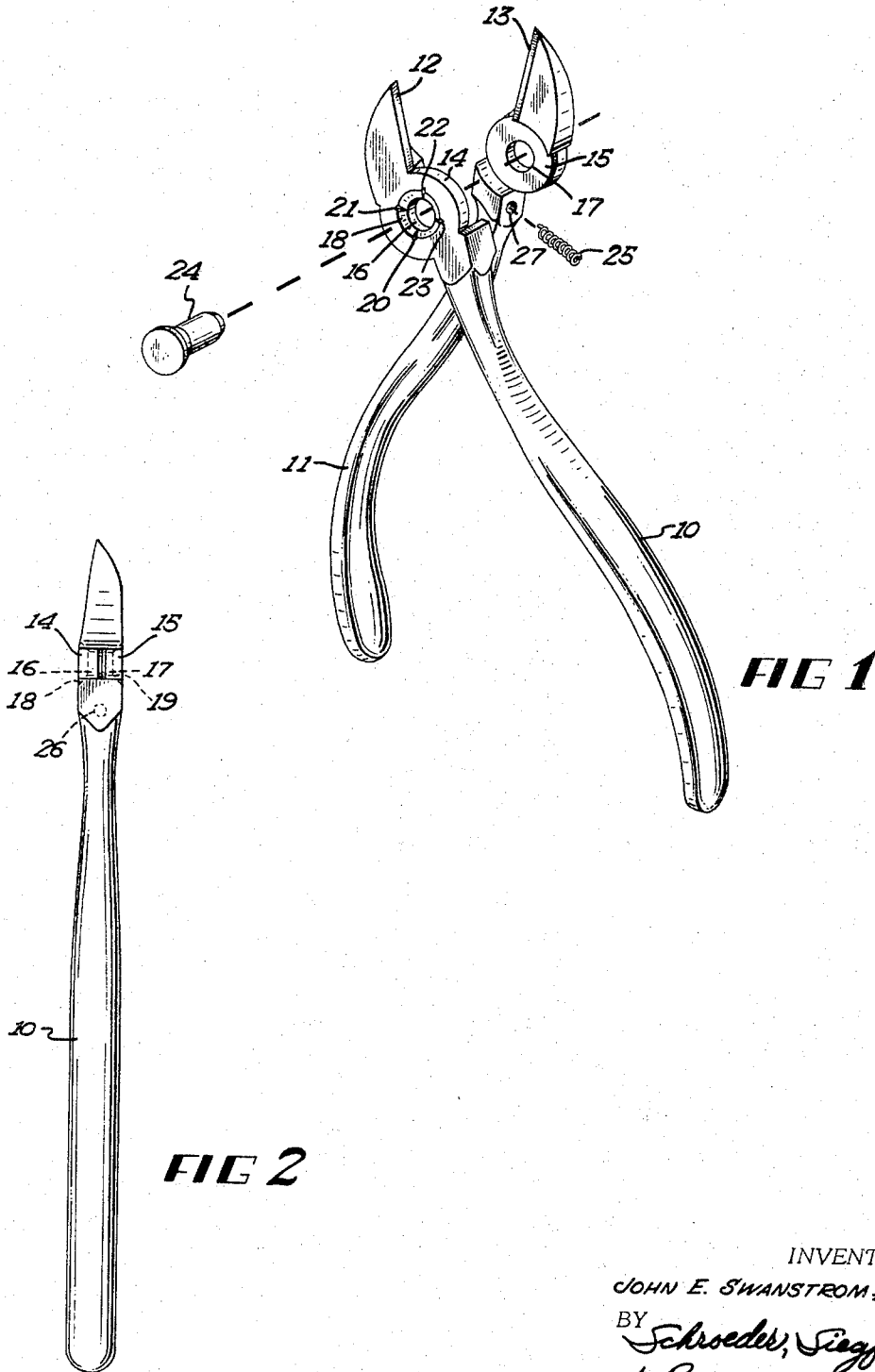


FIG 1

FIG 2

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HAND TOOL

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ABSTRACT OF THE DISCLOSURE

This disclosure relates to a method of fabricating hand tools and also to the structures themselves. The primary emphasis of the construction and method of assembly is to eliminate the problems associated with a steel rivet commonly used to secure the moving parts, and in its place, use a rivet composed of beryllium, cobalt, and copper. The tools are assembled by heat treating the steel handles and work engaging surfaces at a temperature of substantially 1,550 degrees Fahrenheit, after which they are quenched and tempered at a temperature of substantially 850 degrees Fahrenheit, after which the parts have a hardness of 45–48 Rockwell C. The parts are then assembled with the special rivet by staking the rivet. The tool is age hardened at a temperature of substantially 600 degrees Fahrenheit, after which the rivet has a uniform hardness of approximately 40–42 Rockwell C.

This invention relates to the field of hand tools and more particularly to those tools which are assembled by riveting the parts together.

For some time, there has been a need for a pair of pliers, wire cutters, and certain surgical instruments which must be used without any form of lubricant. For instance, in the aerospace field, a number of electronic components have reached such complexity that they are assembled under conditions which are equal to or greater than the cleanliness which must be maintained in a hospital operating room. This cleanliness factor is achieved by so-called "clean rooms" where the rooms are operated under air locks and pressure to cause any foreign matter to be expelled from the room and the personnel working therein, are also required to wear protective clothing and may even be required to be cleansed before entering the room through various means. The equipment which the assemblers use in fabricating the equipment is also subjected to rigid cleaning requirements and hand tools such as long nosed pliers, wire side cutters, and other hand tools are cleaned by such supercleaning processes as sonic and supersonic vibration of the tools in cleaning solutions. In other words, with such emphasis upon superclean tools, there can be no lubricant added to the moving or working parts and thus where the parts are assembled and manufactured using former techniques, the pliers or other hand tools "bind" or tend to "stick" where no lubricant may be applied. It is also obvious that where certain sterilizing techniques are used with forceps or clamps, used in an operating room, that any lubricant would tend to be driven off by the steam sterilizing process.

There is also a particular disadvantage in attempting to manufacture and assemble small hand tools by repeated heat treating processes to produce a better product in that the heat treating process is more difficult to maintain to produce a uniform heat on all of the different parts of the tool and especially the work engaging surfaces and the rivets used to join the parts. That is, where the metal part is thinner or has a smaller cross-section, the heat treating process tends to drive off the carbon in the steel and thus leaves that portion decarburized and this is particularly true of the peened portion of the rivet. If there is a lack of hardness in the rivet heads when assembled,

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without a lubricant, the joint tends to loosen and thus the effectiveness of the hand tool is reduced. Of course lubricating the parts has a tendency to help alleviate the problem of having two surfaces working together which are not as hard as the overall steel structure of the hand tool. An attempt to overcome this problem is also brought out by assembling the the hand tool parts with a rivet, without first heat treating the parts. However, this method also produces a disadvantage since the peening process tends to distort the rivet holes and the rivet itself. It will also be found that where the hand tools can be heat treated in an unassembled condition first, that a more uniform heat treatment can be made causing less warpage from the riveting and allowing a closer fit of the tool jaws which ultimately decreases the amount of grinding and finishing of the tool working surfaces.

In an attempt to comply with industry requirements of manufacturing hand tools without encountering the disadvantages just set forth, the present invention contemplates heat treating the parts separately to provide tool members which may be riveted together with a minimum amount of distortion by using a non-ferrous rivet of beryllium copper and then age hardening the beryllium copper rivet and hand tool to produce a tool which may be operated without lubricant.

It is therefore a general object of this invention to provide improved hand tools with longer and useful life while not using a lubricant.

It is a more specific object of the present invention to provide an improvement in hand tools using hardened non-ferrous rivets which will not tend to freeze or bind.

It is still another object of the present invention to provide a method of manufacture for hand tools in which less machine work and hand finishing is required after assembly of the hand tool.

It is another object of this invention to provide a hand tool using a lubricated age hardened beryllium copper rivet which wears much longer than an all steel hand tool having a lubricant.

It is still a further object of the present invention to provide a method of manufacturing a hand tool allowing more uniform heat treatment of the parts.

These and other objects and advantages of my invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is an exploded view of a typical hand tool before assembly utilizing the invention; and

FIG. 2 is a side elevational view of the tool of FIG. 1 after assembly.

In FIG. 1, there is shown in an exploded view, a pair of side cutters, or wire cutters. The hand tool is formed by a pair of handles 10 and 11 which have a pair of work engaging surfaces 12 and 13 respectively which in this case are in the form of wire cutting jaws. Near the jaw end of the handles, is a joint having a pair of overlapping surfaces on handles 10 and 11 respectively. A hole 16 is formed in handle 10 through the joint face and perpendicular thereto which has a conically shaped end portion 18 that flares outwardly at the outside surface of the handle member. Situated around the edge of the conically shaped hole are four indentations 20 through 23. Situated in the other joint and formed perpendicular to joint surface 15 is another hole 17 which also has a conically shaped flanged portion 19 flaring upwardly at the outside surface of the handle member.

A rivet 24 is passed through holes 16 and 17 and peened or hammered to conform to the conically shaped hole 19. For the particular embodiment shown, a compression spring 25 is fitted into a pair of bores 26 and 27 formed

respectively in handles 10 and 11 on opposing faces lying directly below holes 16 and 17 on the inside portion of handles 10 and 11.

The rivet 24 is formed of a composition of 1.80% to 2.05% beryllium, 0.18% to 0.30% cobalt and the remainder is copper.

In the process of manufacturing the hand tool such as that shown in FIGS. 1 and 2, the two steel handle members including the joint and cutting edges are submitted to a heat treating process in which the members are subjected to a temperature of 1550 degrees Fahrenheit for one-half hour after which they are quenched in oil and then drawn or tempered for one hour or more at 850 degrees Fahrenheit to give a body hardness of 45-48 Rockwell C. The tools are then assembled by riveting the two parts together with the beryllium copper rivet 24, and age hardening the assembly and in particular the rivet, by subjecting the assembly to a temperature of 600 degrees Fahrenheit for one and one-half hours to produce a rivet hardness of 40-42 Rockwell C. Of course this particular treatment also improves the tempering and toughness of the steel pliers or side cutter body parts. After the age hardening process, the hand tool is then ground or finished to put the finished surfaces upon the work engaging portions such as the cutting jaws 12 and 13.

Thus it will be seen that by manufacturing a hand tool such as just described by using the process set forth herein, a much superior hand tool is produced which has operating characteristics heretofore unobtainable. Thus it will be recognized that the improvements shown and described herein in the field of hand tools, produces a tool which may be used without lubrication and yet maintains all of the desirable characteristics of a hand tool produced under regular means of production. Where the hand tool is lubricated and is assembled with an age hardened beryllium copper rivet, it will have a much longer life than that of an all steel tool.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts along with certain variations in the composition of the materials and manufacturing process without departing from the scope of my invention which consists of the matter shown and described herein and set forth in the appended claims.

What is claimed is:

1. The method of manufacturing hand tools having steel work engaging surfaces and handles with a bore formed therein and secured by a non-ferrous metal rivet of uniform hardness having substantially the same hardness on the surface as at the center thereof, the steps comprising:

(a) heat treating the handles and work engaging sur-

faces for substantially one-half hour at a temperature of substantially 1550 degrees Fahrenheit;

(b) quenching the handles and work engaging surfaces in a liquid;

(c) tempering the handles and work engaging surfaces for at least one hour at a temperature of substantially 850 degrees Fahrenheit;

(d) joining the handles and work engaging surfaces with the non-ferrous metal rivet by passing the rivet through the bores and staking the rivet to one of the handles;

(e) and age hardening the hand tool including said rivet, for at least one and a half hours at a temperature of substantially 600 degrees Fahrenheit.

2. The invention as set forth in claim 1 wherein:

(f) the hardness of the handles after tempering in between 45 and 48 Rockwell C hardness;

(g) and where the hardness of the rivet after the age hardening process is between 40 and 42 Rockwell C hardness.

3. The invention as set forth in claim 1 including:

(h) machining the work engaging surfaces of the tool to align the portions thereof.

4. A hand tool of the class described comprising:

(a) a pair of steel handle members having work engaging portions formed at the ends thereof and having a hole formed in each of said members between the work engaging portions and the handle portions, said holes having conically shaped flange portions flaring outwardly at the outside surfaces of said handle members which are concentrically aligned;

(b) and a non-ferrous metal rivet secured to one of said handle members against rotational movement while joining the other of said handle members for rotational movement, said rivet body and flanged portion being formed of a composition of at least beryllium and copper having a substantial uniform hardness of substantially 40 Rockwell C hardness or higher.

5. The invention as set forth in claim 4 wherein:

(c) said rivet is formed of a composition of 1.80% to 2.05% beryllium, 0.18% to 0.30% cobalt and the remainder is copper.

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