April 4, 1961 W. R. MEIER 2,978,353

SAFETY TOOLS

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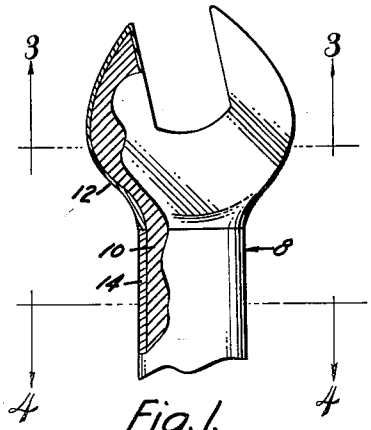


Fig. 1.

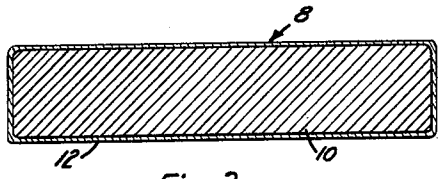


Fig. 3.

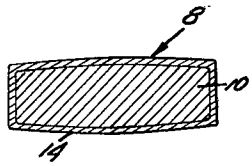


Fig. 4

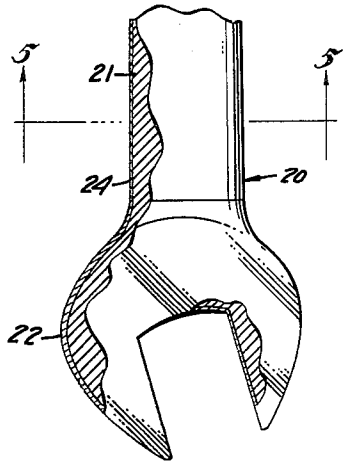


Fig. 2.

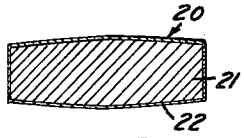


Fig. 5.

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SAFETY TOOLS

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This invention relates to safety tools of the type which do not cause sparks in their use for greatly reducing the danger of explosions in the use of the tools, particularly in ammunition, petroleum and mine uses.

Heretofore safety tools for these uses have been made from soft material. Tools of soft materials, the most popular one of which has been beryllium copper, are claimed by their producers to be spark-proof, although they are not completely spark-proof, whereby there is a possibility of danger in their use.

Presently available safety tools have further disadvantages in that they are frequently made over-sized in an attempt to overcome their weakness whereby they will not work properly in confined places. They have a further disadvantage in that their life is very short as they are easily damaged beyond usability, and they are of no value where severe strain must be exerted to do a job.

For these reasons steel tools are being used in place of the recommended safety tools in violation of safety codes.

It is an object of this invention to provide tools that are completely spark-proof to eliminate all possibility of sparking and explosion, and which are also as hard as a file and as tough as conventional steel tools.

A further object of this invention is to provide tools which are not subject to corrosion, showing little or no reaction to acids.

I am aware that there are many tools, already on the market, having cores surrounded with coating material, however none have coatings suitable for my safety tools. Such tools have coatings which are neither sufficiently hard nor sufficiently thick to serve the purposes of the tools of my invention.

It is a further objective to provide tools so constructed as to provide assurance against the possibility of the coating being worn away in normal use whereby the tools would be no longer safe where there is danger of explosion from spark.

Others skilled in this field have thought of tool sparks as being electrical sparks. At the same time they have thought of these sparks as being caused by the steel content of a tool. This theory was followed because steel tools spark when held to a grinding wheel and because tools which contain minor percentages of steel also spark when held to a grinding wheel.

It has been a common test of a tool, in determining whether it is a safe tool to use in explosion danger areas, to apply a magnet to the tool. If the magnet is attracted to the tool it is believed to contain too high a percentage of steel to be a safe tool.

It is my theory that tool sparks are caused by a fragment of the tool being torn away from the remainder of the tool with sufficient force for causing the fragment to reach its kindling point. It is my further concept that the fragment then oxidizes and the oxidation process causes it to reach a temperature far in excess of its kindling temperature. This super-heat, as I prefer to call it, is the real cause of explosion danger from safety tool

sparks in my opinion, and also is the cause of the visible orange light of a tool spark. The orange light does not come from electricity at all, nor even from magnetic permeability, but does come from the super-heat of oxidation.

Because of this theory I have proceeded to develop tools having a tough core surrounded with a spark-proof, corrosion-proof case, the case being formed of a non-steel material which is non-corrosive whereby its fragments will not unite with the oxygen in the air even though they have reached the kindling temperature of steel whereby the super-heat from oxidation is never generated and the tool is thereby more safe.

Accordingly it is possible by this concept to use a casing material which is actually of a greater hardness than steel whereby a greater amount of force is required to knock a fragment of it loose from the tool than in the case of a fragment of steel, nevertheless the fragment of my casing can reach a temperature higher than the kindling temperature of a fragment of steel and yet will not kindle or oxidize because of its non-corrosive characteristics, thereby having a lesser tendency to oxidize.

Safety tools have heretofore been made of expensive materials such as beryllium copper and these expensive materials have been used throughout each such tool. It is an object of my invention to provide a tool made with a relatively inexpensive core and coated with a spark-proof, corrosive-proof case, in this way substantially reducing the cost of safety tools.

A further object of my invention is in the provision of a tool having an inexpensive core, having a spark-proof, corrosion-proof casing at the ends or other working surfaces of the tool and having a very inexpensive spark-proof plastic coating on handle areas and other non-working areas of the tool in order to further conserve expensive spark-proof metal coating material to make the tools still more inexpensive.

Other and further objects and advantages of the present invention will be apparent from the following detailed description, drawings and claims, the scope of the invention not being limited to the drawings themselves as the drawings are only for the purpose of illustrating a way in which the principles of this invention can be applied.

Other embodiments of the invention utilizing the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Figure 1 is a top plan view of a hand wrench with one modification of a spark proof coating of my invention applied thereto;

Figure 2 is a plan view of one end of a hand wrench showing a different modification of the spark proof coating of my invention as applied thereto;

Figure 3 is an enlarged cross-sectional view taken along the line 3—3 of Figure 1;

Figure 4 is an enlarged cross-sectional view taken along the line 4—4 of Figure 1; and

Figure 5 is an enlarged cross-sectional view taken along the line 5—5 of Figure 2.

Referring to the drawing, in Figure 1 a wrench 8 is shown having a core 10 having a suitable preferably metallic sparkproof coating material 12 in accordance with my invention and covering the working surfaces of the wrench. Such a coating can be approximately 1/64 inch if desired.

A suitable plastic coating 14 encases the handle portion of the wrench 10 and can be of greater thickness than the coating 12, if desired, without excess cost, for example approximately 1/32".

In Figure 2 a wrench 20 is shown having a core 21 having a working surface coating 22 and a handle or non-working surface coating 24, both of a same suitable sparkproof material such as a metal. The coating 22 is of approximately a 1/64 inch thickness or more if desired although the handle coating 24 can be of much lesser thickness when hard metal is used, as shown, such as between five and ten thousandths or more since the wear on a non-working surface is much less.

The coatings 12, 14, 22 and 24 are otherwise made according to any of the instructions hereinafter set forth in detail.

Process of manufacture

I prefer to coat my cores by the metallizing process which is the spraying of the coating material on the core. Thereafter the tool can be subjected to heat until the coating is sintered, causing the coating to form a continuous, impervious protective casing. The sintering step is necessary because the metallizing spraying causes the coating to be relatively porous whereas the sintering causes it to be a continuous coating in which the individual particles strongly adhere.

I use either boron or silicon, or both, as an ingredient of the formula of the casing material because either boron or silicon function as a flux in the sintering process.

The boron and silicon serve two purposes because after they have served their purpose as a flux they serve the further purpose of being hardening agents.

I prefer to use boron as the flux and hardening agent because then the coating can be sintered in the atmosphere whereas with most of the other hardening agents, sintering must be carried out in ovens with reduced oxygen. It is necessary to have a flux to prevent steel from oxidizing until such time as the coating has reached a temperature sufficient for sintering.

However, when an oven is used of the type having gas in it which does not have substantial oxygen content, then it is possible to use coating materials which do not contain flux.

In such ways of manufacture and when flux is unnecessary, it is possible to use other hardening agents such as aluminum oxide, ferrous zinc, tungsten, molybdenum, tantalum or the various carbide alloys.

Another and preferred process of applying the coating is to coat the tool with the casing material by applying the coating material like paint by mixing the powdered coating material with a suitable vehicle, such as thermoplastic acrylic resin, then sintering the coating as above described, the resin burning away in the sintering process, to leave a continuous coating of metal.

A further way of applying the coating is in the application of powdered coating material to the core by pressing the powdered material around the core in a die. Following this the tool is removed from the die and is then heated until the coating is sintered.

A further method of manufacture would be in applying the casing material to the core in a mold and then sintering the casing material while the tool is still in the same mold and before removing it.

Butryrate and vinyl plastisol symbolize the plastic group that might be used on nonworking surfaces. Other plastics might be used. For instance acrylic or epoxy resins mixed with powdered metals would make suitable coatings or handles for nonworking surfaces.

From the foregoing description, it is thought to be obvious that safety tools constructed in accordance with my invention are particularly well adapted for use, by reason of the convenience and facility with which they may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification without departing from the principles and spirit thereof, and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice, except as claimed.

I claim:

1. In a spark-proof hand tool of the character described, an inner frame of steel defining the basic shape and location of the work-engaging surfaces of the tool, and a non-sparking coating over the entire surface of said tool, said coating consisting essentially of a nickel-chromium-boron alloy integrally united with said internal frame, the thickness of said coating over said work-engaging surface being approximately 1/64 of an inch.

2. In a spark-proof hand tool of the character described, an inner frame of steel defining the basic shape and location of the work-engaging surfaces of the tool and a non-sparking coating over the entire surface of said tool, said coating on the work-engaging surfaces of the tool consisting essentially of a nickel-chromium-boron alloy integrally united with said internal surfaces and said coating on the non-work-engaging surfaces consisting essentially of a synthetic resin integrally united with said surfaces, the thickness of said coating over said work-engaging surface being approximately 1/64 of an inch.

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