Patented Dec. 29, 1931 1,838,273

# UNITED STATES PATENT OFFICE

BYRON V. McBRIDE, OF IRWIN, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

## METHOD OF PRODUCING CHROMIUM PLATED TOOLS

No Drawing. Application filed December 24, 1927. Serial No. 242,525.

My invention relates to tools and implements of all descriptions having one or more cuting edges or pressing surfaces and more particularly to a process of coating the cutting edges or pressing surfaces of such tools or implements with a protective layer of chromium.

An object of my invention is to provide the surfaces of cutting or pressing tools, such as saws, reamers, files, gauges, die presses and drilling bits, that are usually made of steel, with a protective layer of chromium to render their surfaces relatively hard and non-tarnishable.

Another object of my invention is to provide chromium-plated tools or implements that are tough, elastic and free from the brittleness which has heretofore been a characteristic of articles plated with chromium.

A still further object of my invention is to provide a process of producing chromium-coated tools or implements that are non-tarnishable and free from brittleness and that have a longer life and a better cutting or pressing surface than tools or implements made entirely of steel.

It has heretofore been the practice to make the tools or implements utilized for cutting or pressing operations from a high-grade steel. The life of such implements or tools, however, has been comparatively short, because of the extreme service to which they are subjected; and this is true even when they are produced under the most favorable conditions, with respect to workmanship and the quality of material employed. Much difficulty has also been experienced with cutting tools made of steel, such as hack saws and files, because the grooves or interstices between the cutting edges have had the tendency to become clogged and this is especially true when they are employed for cutting or abrading soft surfaces.

I have made the discovery that, when a tool or implement of any one of various kinds, such as files, hack-saw blades or drilling bits, gauges, dies or presses, has been coated with a layer of chromium by my improved process, the hardness of the cutting or pressing surface will be greatly increased, and a non-tarnishable tool or implement that is superior in cutting or abrading properties will be produced.

It is well known that, when chromium is electro-deposited upon a metal, such as copper, iron or steel, a surface is obtained that is considerably harder than the foundation metal upon which the chromium is plated. Attempts have been made to coat tools or implements that are subjected to severe usage, with chromium for the purpose of increasing their durability. Efforts along this line, however, have not been successful mainly because of the extreme brittleness that is imparted to the tools. By my improved process, the elasticity of the foundation metal, which has been rendered brittle during the chromium-plating process, is restored, and chromium-plated tools or implements are produced that are free from brittleness.

In practicing my invention, the tool or implement to be plated is first thoroughly cleaned of all dust and dirt by polishing with emery cloth of a very fine grade, or, if preferred, it may be cleaned by dipping in a dilute solution of sulphuric acid, an alkaline cleaning solution, or other pickling bath, and the excess pickling or cleaning solution may be subsequently removed by dipping in water.

The tool or implement, in its thoroughly cleaned condition, is then employed as a cathode in a chromium-plating bath, in conjunction with a lead or iron anode. Any of the well known chromium-plating baths may be utilized, but I prefer to use a bath composed of a dilute solution of commercial chromic trioxide. The commercial chromic trioxide usually contains sufficient chromic sulphate to afford a good plating solution, but, if necessary, additional amounts of either chromic sulphate or chemically pure chromic trioxide may be added to obtain the desired bath.

The bath is preferably composed of the above specified ingredients in the proportions of about 33.3 ounces of chromium trioxide and one ounce of chromium sulphate to each gallon of water. While any suitable anode may be utilized, I prefer to place the

solution thus obtained in a lead-lined wooden vessel, the lead lining serving as the anode and the tool or implement to be plated serving as the cathode.

When the temperature of such bath is kept at about 60° C., and a current density of two amperes per square inch is maintained at the cathode, a sufficient layer of chromium may be deposited upon the surface of the tools in about 30 minutes. It will be understood, however, that, at lower temperatures, a lower current density may be utilized, but it will require a longer time to deposit the layer of chromium upon the tool or implement. Therefore, I do not desire to limit myself with respect to the constituents of the bath, the current density, or time required to plate the chromium upon the surface of the tool or implement, but any bath may be utilized which, at the requisite temperature and current density, will produce the desired coating.

Tools or other implements provided with layers of chromium electro-deposited in the manner specified, are brittle and unsuitable for cutting or pressing operations. The exact cause of this brittleness is not known, but I believe that the hydrogen formed at the cathode during electrolysis is occluded into the foundation metal. After the implement or tool has been coated with a sufficient layer of chromium, it is removed from the bath, suitably dried and subjected to a heat treatment to remove the occluded hydrogen. The temperature necessary to expel the hydrogen will, of course, vary considerably but it should not be high enough to cause the layer of chromium to alloy with the foundation metal or to effect changes in the crystallization of the foundation metal which will decrease its hardness. When a chromium-plated tool is subjected to a temperature of from 50 to 350° C. for a period of from 1 to 24 hours, depending upon the size of the tool and the thickness of the chromium plating, the elasticity of the tool will be entirely restored.

The chromium-plated tools or implements obtained by my novel method are harder than steel, are non-tarnishable, and the toughness and elasticity of the steel or other foundation metal is not impaired in any manner. The life of tools plated with chromium by my improved process is increased from two to five-fold; their hardness and cutting surfaces are superior to tools made of steel alone, and the interstices between the cutting teeth or grooves do not become clogged with soft material being sawed, filed or abraded.

Saw blades coated with layers of chromium by my improved method have been found to exhibit a remarkable superiority over saw blades made of steel. In a test made on drilling bits, it has been found that a bit made of the best grade steel would only drill 90 pieces of porcelain, but, when such bit was coated with chromium, by my improved process, it was capable of drilling from 400 to 500 pieces.

The term "tools", as used in the specification and claim, is intended to include hack saws, drills, reamers, presses, gauges, dies and other implements having pressing and abrading as well as cutting surfaces.

While I have described a specific form of my invention, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. I desire, therefore, that only such limitations shall be placed on my invention as are imposed by the prior art and the appended claim.

I claim as my invention:

The method of producing a chromium-plated tool which comprises electrodepositing a layer of chromium on a steel tool and then subjecting the chromium-coated tool to heat at a temperature of 150 to 350° C. for a period of from 1 to 24 hours, according to the size of the tool and the thickness of the chromium plating.

In testimony whereof, I have hereunto subscribed my name this 15th day of December, 1927.

BYRON V. McBRIDE.