Patented Aug. 25, 1925. 1,551,333

UNITED STATES PATENT OFFICE.

KARL SCHRÖTER, OF LICHTENBERG, AND WILHELM JENSSEN, OF SCHONEBERG, GERMANY, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TOOL AND DIE.

No Drawing. Application filed December 27, 1922. Serial No. 609,326.

To all whom it may concern:

Be it known that we, KARL SCHRÖTER and WILHELM JENSSEN, citizens of the German Republic, residing, respectively, at Lichtenberg, Germany, and Schoneberg, Germany, have invented certain new and useful Improvements in Tools and Dies, of which the following is a specification.

Our invention relates to hard tools, dies, molds, drawing blocks and other implements. Heretofore devices of this type have been made from carbides of metals which fuse at high temperatures. Such devices are not satisfactory for use in connection with the working of metals such as tungsten because such devices are too brittle and are also too coarse and they break easily.

Our invention relates to the method of making such devices which are free from the above objections. For the purpose of making such tools or devices, we make use of metals that fuse at a temperature of over 1000 deg. C. and which are found in the fourth, fifth and sixth groups of the periodic system. We also may use their mixtures or alloys. Tools made from these metals we treat with carbon, boron or other metalloids in such a manner that their working surfaces are rendered hard by such material. This can be done by heating the metal in an atmosphere of these substances and at a temperature below the fusing point of the metal, mixture or alloy. The process of our invention is hereinafter more fully set forth and claimed.

Among the specific elements which may be used and treated in accordance with our process are the following: titanium, zirconium, thorium, silicon, vanadium, tantalum, chromium, molybdenum, tungsten, uranium. We may also use alloys of these metals or their mixtures. Such a metal can be brought to the desired form by taking the powder of the element, as in the case of tungsten, and molding it into the desired shape in a hydraulic press, after which it is heated in a neutral or reducing atmosphere to sinter. It is also possible to forge or cast the metal alloy or mixture in which case sintering is not necessary.

After the metal has been formed into the desired shape, it is subjected to a carbonizing, boronizing or a similar process at a temperature below the fusing point of the metal. For this purpose the tool or implement is heated in an atmosphere containing either carbon, boron or the like, such for example, as hydrocarbons, boron hydride, carbon oxide, etc. or suitable mixtures of the same. As an alternative, the implement may be covered with carbon, boron, or carbon or boron containing substances which at the temperature employed readily give off carbon or boron to the implement. The process may also be carried out in a carbonizing or boronizing gaseous atmosphere until the gas is reduced to a neutral condition. It is also possible to start the process with one gas and complete the process with a different gas and the sequence as well as the mixture can be varied to obtain any desired result, as for example, to produce an outer coating of suitable hardness on top of substrata of diminishing degrees of hardness. The separate layers or zones do not change sharply in hardness; one layer gradually merges into another so that the outer layer is richest in carbon, gradually diminishing toward the interior. The same is the case with respect to boron and the like. In certain cases after the implement has been treated and subjected to some mechanical treatment, as for example, grinding, polishing and the like, it is necessary to repeat the carbonizing or boronizing process in order to finally obtain an implement with the desired degree of hardness. Implements of this kind are specially adapted for drawing blocks for drawing tungsten wire. Such material is also especially adapted for other work where exceptionally hard surfaces are required. Metals prepared in accordance with this process can be used also for face plates, crucibles and also for armature and stove parts.

It will be seen, therefore, that tools and implements made in accordance with our process have several zones which vary in hardness as the layer approaches the surface, the hardest layer being found on top.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. An implement having as a foundation one of the elements of the fourth, fifth and sixth groups of the periodic system fusible

at over 1000° C. and provided with a surface having in combination such element and a metalloid.

2. An implement having as a foundation one of the elements of the fourth, fifth and sixth groups of the periodic system fusible at over 1000° C. and provided with a surface consisting of layers of different proportions of the metal and a metalloid.

3. An implement having as a foundation tungsten and provided with a surface having in combination such element and a metalloid.

4. An implement having as a foundation tungsten and provided with a surface consisting of layers of different proportions of the metal and a metalloid.

In witness whereof, we have hereunto set our hands this 4th day of December, 1922.

KARL SCHRÖTER.
WILHELM JENSSEN.