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PLATES AND BODIES TO BE APPLIED ON
IRON TOOLS AND MACHINE MEMBERS

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The present invention relates to plates and bodies to be applied on iron tools and machine members.

It is known that the working surfaces of tools and machine members which are particularly exposed to wear may be rendered resistant to wear and tear by brazing on to these surfaces, for instance, plates or other bodies made of hard metal or metal alloys or by building up a layer of such alloys resistant to wear, such as, metal carbides or stellite-like alloys.

Plates or shaped bodies entirely made of sintered hard metal alloys have, as it is known, only a low coefficient of thermal expansion as compared with other metals. This peculiarity of the hard metal alloys requires great care and skill in the preparation of workpieces provided with such plates. Tools or machine members of normal construction and also certain kinds of alloyed steel which are exposed to a high thermal strain are often unsuitable for being coated with plates of hard metal alloys. In order to avoid tension cracks, the plates of hard metal alloys must be brazed with great care and only by trained workmen. The mean coefficient of thermal expansion within a temperature range from 20° C. to 100° C. amounts, for instance, in the case of a carbon steel to about $11.10 \cdot 10^{-6}$, and in the case of a hard metal alloy of the class known as cemented carbides having for instance the composition of 88% of tungsten, 6% of cobalt and 6% of carbon to only $5.10 \cdot 10^{-6}$. Considering the intermediate layer formed by brazing and the coefficient of thermal expansion of the copper preferably used in this case with $17.10 \cdot 10^{-6}$, the path of the thermal curve is very unfavorable. Moreover, when building up hard metal alloys on workpieces of small thickness, for instance, the contact surfaces of many measuring instruments, distortions easily occur.

These drawbacks of the known processes are avoided, according to the present invention, by fixing on the workpieces plates or shapes which consist of at least one outer layer of a metal or a metal alloy resistant to wear and at least one fixing layer which, when the plates have been fixed to the iron support, is adjacent to this support; the coefficient of thermal expansion of the metal of the fixing layers being equal to or near that of the metal of the workpiece. For the fixing layers there is suitably chosen a metal or metal alloy whose coefficient of thermal expansion lies between that of the support metal and that of the metal alloys of the outer layers which are fast to wear. Outer layers and fixing layers are combined to a solid inseparable body gener-

ally by at least one intermediate layer obtained by the formation of mixed crystals, by alloying or by diffusion.

Suitable plates and shapes are, for instance those composed of the following metals, the order being from the outside to the inside: tungsten carbide/mixed crystals/iron, or : tungsten carbide/mixed crystals/cobalt, in case the metal of the workpiece is a carbon steel; or : chromium/mixed crystals/carbon steel in case the metal of the workpiece is an alloyed steel, for instance, of the type used for valves.

The exterior layer or the working surface of plates or shapes prepared according to the present invention may consist of any suitable metal or a corresponding metal mixture. Preferably there are used hard metals alloys of known composition with or without addition of auxiliary metals of low melting point. Furthermore, heavy metals of high melting point and compounds thereof can be used either alone, mixed with each other or in admixture with metals of low melting point as well as stellite-like alloys.

As fixing layers there are especially suitable metals with which the metals of the outer layer form alloys or mixed crystals. Preferably there are used metals of the iron group, that is to say, cobalt, nickel or the alloys thereof, as well as carbon steel or alloyed steel.

The outer layer resistant to wear may be connected to the fixing layers in one of the various ways known per se. Thus, the outer layer may be melted on to the fixing layers, for instance, by autogenous or electric building up or sintering. In the latter case the pulverized metals are advantageously pressed on to a plate of the fixing layer which plate is roughened on the side next to the outer layer resistant to wear. It is, however, also possible to first compress the fixing layer of, for instance, pulverized iron, cobalt, nickel or the like or the alloys thereof, to press thereon the pulverized metal or metal alloy of the outer layer resistant to wear and then to sinter the whole body.

Instead of one single fixing layer there may also be used several such layers, the content of hard metal alloy diminishing gradually from the outer layer to the support. This may be accomplished by adding to the pulverized metal of the fixing layer parts of the metal or metal compound of the outer layer in such a degree that the lowest layer contains no or hardly any hard metal alloy and the upper layer contains a relatively large amount thereof.

The body consisting after building up or sin-

tering of three zones: outer layer resistant to wear, layer of mixed crystals, fixing layer is brought to the correct form by mechanically treating the fixing layer which is generally soft and by grinding and polishing the outer layer which is generally very hard and resistant to wear. The thus finished plate or shape is then ready to be combined with the support.

The plates and shapes resistant to wear and tear, prepared according to the present invention, may be fixed on a tool or a machine member in various ways. If the parts are to be united by welding, the tool and the plates are heated in a furnace to red heat, a suitable welding powder is strewn on the surface of the workpiece and the plate to be fixed is placed thereon. The body is then heated to white heat and the intimate union is effected by a slight pressure or stroke. The body is advantageously cooled in ashes or pulverized coal.

Plates and tools may also be combined by electric resistance welding or the soft fixing layer carrying the hard metal may be fixed to the tool by screws. The application of dovetailed grooves in the fixing layer and shrinking-on of the plates thus formed to the tool are also possible.

Tools thus prepared may be cautiously hardened or annealed without detrimental effect on the outer layer of the plate, said layer being in most cases a naturally hard body.

It has already been proposed to insert between the plate consisting throughout of hard metal and the workpiece a thick-walled trough of a relatively hard and tough metal into which the plate is brazed. This trough is intended to protect the plate against unfavorable mechanical influences and detrimental tensions which may be caused by the influence of heat, not only by separating the plate on all sides from the workpiece but by protecting it at the same time effectively against the tensions occurring during the use of the tool or the brazing process. Consequently, the coefficient of thermal expansion

of the metal used for the trough is very low and—in contradistinction to the prescription of the present invention—is nearly equal to that of the metal used for cutting tools. Moreover, plates and trough are not combined to a solid, inseparable body by a layer formed by mixed crystals or the like according to the idea underlying this invention.

Contrary thereto, the combination of the outer layers, resistant to wear, and the fixing layers by means of intermediate layers of mixed crystals which are partly formed by the metal of the outer layer and partly by the metal of the fixing layers results in a product of great mechanical strength. A subsequent separation even under the influence of great heat when the tool is in use is not possible. A further advantage is the favorable adaptation and gradation of the coefficient of thermal expansion of the different layers of the plate and the workpiece proper whereby a tool of long life is obtained.

We claim:

1. Plates and bodies for application to iron tools and machine members, said plates and bodies consisting of an outer metallic layer of cemented carbides, an inner layer of a metal having a coefficient of expansion approximating that of the tools and machine members, and an intermediate layer operating to permanently unite the inner and outer layers and comprising mixed crystals of the metals of the outer and inner layers resulting from the direct surface-diffusion or -alloying of the metals of the inner and outer layers.

2. Articles as defined in claim 1 wherein the inner layer is of a metal of the iron group.

3. Articles as defined in claim 1 wherein the inner layer is of a metal of the iron group and the outer layer is of cemented tungsten carbide.

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