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[54] **METHOD OF REDUCING WEAR OF A CEMENTED CARBIDE ROLL**

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[58] **Field of Search** 204/148, 197; 72/201, 236; 29/110, 129.5, 132

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[57] **ABSTRACT**

Rolling mill rolls, formed of hard metal, used for the hot rolling of metals are subject to serious wear and related destructive influences. Such wear can be reduced by giving the rolls electrochemical cathodic protection, in which the electrolyte is the cooling water used in the hot rolling operations and sacrificial anodes are associated with the hard metal rolls.

2 Claims, 2 Drawing Figures

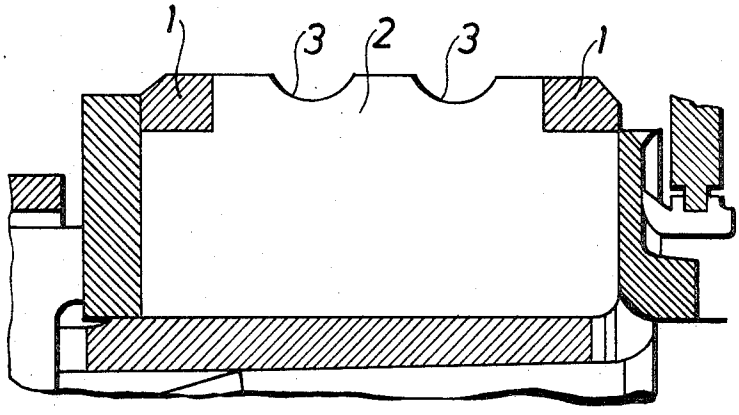


Fig.1

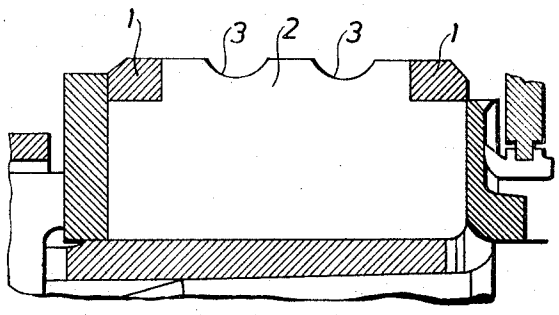
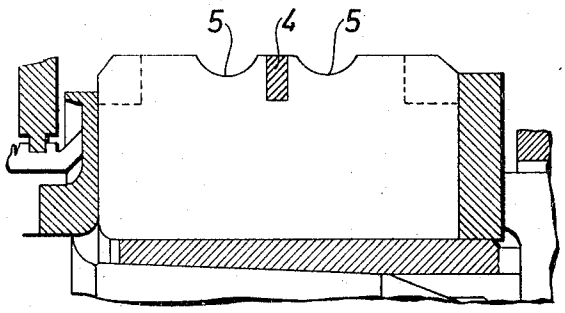


Fig.2



METHOD OF REDUCING WEAR OF A CEMENTED CARBIDE ROLL

The present invention relates to a method of reducing the wear of a roll of sintered carbide in hot rolling of metal or similar.

Rolls of hard metal have been used for cold rolling metal strips and the like for a long time. Furthermore, hard metal rolls lately have been used in hot rolling to a greatly increasing extent and preferably in rolling of wire at very high rolling speeds. For natural reasons, such rolls are exposed to great mechanical strain and to other destructive influences including wear, corrosion and thermal fatigue.

According to the present invention, it has surprisingly been found possible considerably to reduce the wear of a roll of cemented carbide by applying methods of electrochemical cathodic protection. Available water for cooling the roll is then used as an electrolyte.

Cathodic protection of metals against corrosion has, in general, long been used. There may be mentioned ship bodies, oil tanks of tankers and hot water tanks. It is also known to protect parts of rolling mills as for instance roll necks and slide bearings by means of cathodic protection and in the same way also rolls, drying cylinders and other parts of paper making machines. In the mentioned cases the protected body has usually been made of steel. It is also known, however, to cathodically protect articles formed of sintered carbide of general composition. Here may be mentioned for example cutting of timber, in which process the saw blade has been provided with teeth of cemented carbide. By connecting the saw blade as cathode and the log of wood as anode in an electric circuit the rate of speed of the blunting of the teeth could be decreased. In such case, the moisture of the wood acted as electrolyte. In the blunting of the teeth, i.e. the wear of the cemented carbide, corrosion as well as pure wear thus played an essential role.

Hitherto it has been considered impossible to reduce the wear of hot rolls of sintered carbide in a corresponding way. Against this possibility there are thus the high temperature of the rolled product, — usually about **1000°** C., — as well as the complicated cooling of the roll usually comprising spraying of high pressure water from nozzles placed in a suitable way. The resulting liquid contact seems quite insufficient to make satisfactory cathodic protection possible.

It has now been found possible, however, to obtain substantially reduced wear of a hard metal roll in hot rolling by means of relatively simple arrangements according to the principles of electrochemical corrosion protection. In the method according to the invention the protective current may, according to principles known per se, be produced by galvanic anodes or by an applied potential.

In the first case, cathodic protection is obtained by connecting the hard metal roll to a piece of a baser metal. The galvanic anode or "sacrificial" anode shall in the present method be made of a material having at least 250 mv lower electrochemical potential in relation to the sintered carbide measured in actual electrolyte and at actual temperature. Such a material is in the first instance aluminum or an aluminum alloy, but also Mg and Zn and their alloys have proved to be suitable. In the method according to the invention it has been found favorable to apply the sacrificial anode firmly to the very sintered carbide roll.

The invention will now be described in greater particularity and with reference to the appended drawing, in which

FIG. 1 is a diagrammatic representation, partly in cross-section, of a portion of a rolling mill roll embodying principles of the present invention; and

FIG. 2 illustrates a further embodiment of the invention constituting a modification of that shown in FIG. 1.

In FIG. 1 there is shown an embodiment in which anode rings 1 have been applied at the periphery of the sintered carbide roll 2 by means of interference fit, shrinking-on, soldering, casting or the like. (Other sectioned faces show details for clamping the very roll.) It was found particularly suitable to use interference fit in mounting the rings, and such mounting did not give any crevice corrosion or other disadvantages. The remote effect of the anode was satisfactory also upon the further side of the groove 3 counted from the anode.

In certain cases, however, it has been found suitable to let an extra groove 4 between the roll grooves 5 be filled with anode material (see FIG. 2). By using anode rings the benefit of a compact, "prefabricated" roll is obtained, which roll can be directly put into the rolling mill for replacing a conventional roll. The strength of the roll is not risked when using peripherally placed rings which obtain the same diameter as the rest of the roll in the normal regrinding of the roll.

Instead of using rings, it has often been found sufficient simply to fill with such anode material holes made in the roll face to receive pins or other complementary shapes of such fillings. The last-mentioned technique has sometimes been used as complement to employing anode rings. In like vein, the features of FIG. 1 and FIG. 2 may be combined.

The following example makes clear the improvements obtained with hard metal rolls treated according to this inventive method. Upon two sintered carbide rolls (diameter $\phi = 156$ millimeters respectively $\phi = 206.5$ millimeters and provided with oval grooves), two anode rings of an A1 alloy were applied at the periphery of the rolls. The first-mentioned roll had two grooves whose central lines were spaced 22 millimeter's distance from each end face of the roll. The applied anode rings had rectangular (10 × 5 mm) respectively square (10 × 10 mm) section. The last-mentioned roll had only one groove situated at a (central line) distance of 22 mm from the end face and was protected by rings having the sections 10 × 5 mm respectively 10 × 8 mm. During rolling the predetermined regrinding criterion of the first roll was reached after 1,480 tons (of rolled product) and in the second roll after 1,560 tons of rolled material. Corresponding rolls which were tested under the same circumstances but missing anode rings had to be reground after 1,020 respectively 1,050 tons. The improvement thus was 45 percent respectively 49 percent.

Besides permanently applied anodes as the mentioned rings, pins and so on, also exchangeable anodes may be used, i.e., material which suitably is renewed when the roll has to be reground because of wear. Among such anodes may be mentioned strip, wire and equivalent, which are applied to the roll by means of winding, cementing, welding, mechanical clamping or other ways. Coated layers of anode material applied by

spraying, plating, pasting, etc., upon the surfaces of the roll may also belong to the group. Such anode materials in the form of powder, etc., may be mixed with adhering material such as resin or tape as binder for such powder.

In other cases in which the wear has been great, it has sometimes shown insufficient to protect the roll by means of firmly applied anodes. In these cases it has often been favorable to use drag anodes which are pressed by an adjustable spring force towards the roll body or groove. Very effective cathodic protection has been obtained by pressing the drag anode with such a great force against the roll that anode material is continually pasted upon the roll surface. Such anodes may suitably be made as rod, strip, rolls, wire, etc. Corresponding effect has sometimes been obtained also by letting the rolled billet come into contact with the anode, for instance, by passing it in contact with a container with melted or mixed anode material therein.

In many cases it has been found more suitable and practical to apply the anode material upon different construction details in the proximity of the sintered carbide roll. Effective protection has been obtained by — for instance — coating or providing sealings, frames and clamping means for rolls with anode material. Existent shields for roll necks or other roll parts have suitably been made of such sacrificial anode material.

It may in some instances not be necessary to maintain a wholly metallic conducting contact between anode and sintered carbide roll. Sufficient protection has sometimes been obtained by means of liquid contact. There may be mentioned anodes in the form of shields so applied that slots for the cooling water have been formed between shield and roll, or anodes in the form of nozzles for cooling water. Shields have been found effective by bringing the electrolyte, i.e. the cooling water, to flow more laminarly and regularly at the actual high rotation speeds. By liquid contact, a closed electric circuit has been maintained by means of return conductors between anode and roll.

Of the mentioned methods, different combinations and variants are possible in the scope of the invented method. Also there are included methods in which the protective current is produced by an applied potential.

We claim:

1. Method of reducing the wear in a roll of cemented carbide during hot rolling of metal at very high speed and severe strain, which consists in providing the roll with electrochemical cathodic protection by using the available cooling water as electrolyte and, as anode, at least one ring formed of a metallic material having a significantly lower electrochemical potential than that of the cemented carbide, said ring being applied on the periphery of the roll and so formed that its outer diameter is the same as the diameter of the roll.

2. Method according to claim **1,** wherein the anodic ring is formed of aluminum.

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