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TREATMENT OF STEEL TOOLS

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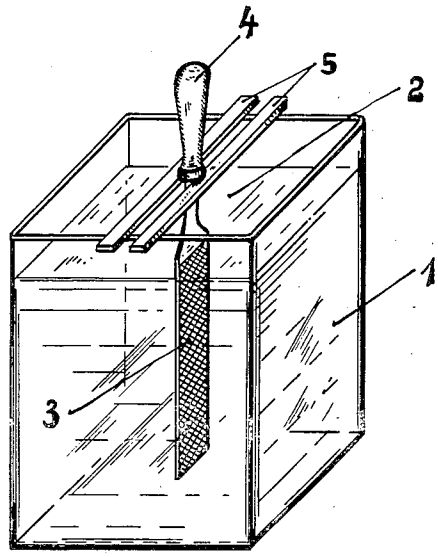

Fig. 1

Fig. 3 Fig. 4

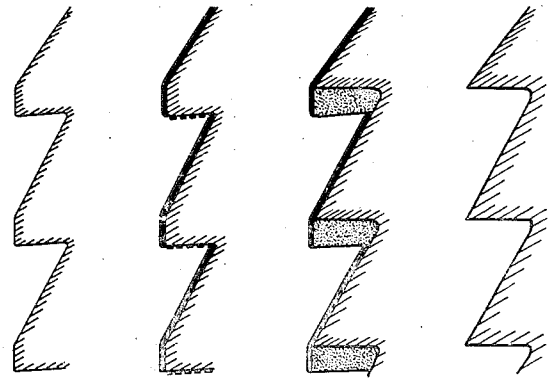

Fig. 2

Fig. 5

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TREATMENT OF STEEL TOOLS

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The present invention relates to the treatment of steel tools and more particularly to a process for improving and sharpening tools having cutting edges, such as files, rasps, milling cutters, saws, knives and the like. The word "improving" is employed in this specification to mean "improving the cutting properties" of tools of the aforesaid kind whether they be new unused tools or old tools which have become blunt in use.

According to the present invention a process is provided wherein by chemico-electrolytical treatment with chemical substances, the soft constituents of the metal (particularly the ferrite), which are more readily soluble in the said chemical substances, are dissolved out of the blades or cutting edges of the tools, whilst the hard, more valuable, difficultly soluble constituents (particularly the pearlite and cementite) are only attacked to a lesser extent and therefore remain for the most part in the metal. At the same time worn cutting edges are reinstated, inasmuch as the action of the chemical substances in the chemico-electrolytical process according to the invention takes place at the lower part of a cutter or tooth at a different speed from that at which it takes place at the upper part of the cutter or tooth, as a result of which the cutter is naturally renewed. The aforesaid results may be obtained according to the invention in the following manner:

The accompanying drawing illustrates by way of example a method of carrying out the process according to the invention in practice.

In the drawing:

Fig. 1 shows a file suspended in the solution,

Fig. 2 shows diagrammatically the cutting edges of the file in the blunt condition,

Fig. 3 shows the cutting edges of the file after the treatment has commenced,

Fig. 4 shows the cutting edges of the file after the deposit has been formed, and

Fig. 5 shows the cutting edges of the sharpened file after the etching operation is complete.

Referring to the drawing:

The file to be treated is suspended in a solution 2 contained in a vessel 1 with its cutting edges 3 downward and its handle 4 upwards, the said handle 4 being supported on small battens 5, the ends of which rest on the edges of the vessel 1 as clearly shown in the drawing.

If it is desired to improve or sharpen a cutting tool, for instance a file which has become blunt, the tool is suspended vertically with the tang upwards, as shown in Fig. 1, in an aqueous solution of an acid capable of dissolving steel, for instance nitric acid, if desired in admixture with sulphuric acid, and at least one salt of one or more metals which are more electro-positive than iron. As a result of the addition of the metallic salts the metal in question is deposited in the form of a metallic coating on the steel, whilst at the same time the equivalent amount of iron goes into solution. The electrical element constituted by the steel, the acid and the said metal, prevents the steel from becoming inert and assists the process of dissolving the latter. The metallic coating possesses a different degree of adherence to the file or other tool and is of different densities at different places, the said coating being more adherent and denser at the upper parts of the cutters or teeth, i. e., the parts directed towards the surface of the bath, than at the lower parts of the cutters or teeth, inasmuch as the hydrogen gas, which is formed during the process of dissolving the steel and which is prevented from ascending by the overhanging cutters and collects on them, produces the result that the metallic coating at the lower parts deposits in a spongy and loose form and is therefore less adherent and less dense than at the upper parts of the cutters or teeth, see Fig. 4. The dissolving or etching bath constituted by the aqueous solution penetrates more easily through the less dense coating, so that the cutter or tooth is more strongly acted upon at the places where the coating is less dense. The cutting edge of the cutter or tooth cannot become rounded off, inasmuch as it is protected from above. The etching action which takes place substantially from below naturally also effects a cutting edge which is already existent, but when an existent cutting edge is attacked a new cutting edge is always formed again. As the less valuable softer constituents of the steel are dissolved more rapidly than the more valuable harder constituents, the new cutting edge which is formed consists principally of the more valuable constituents and is therefore more useful and more efficient. Inasmuch as, after a certain time, the denser metallic coating also becomes loosened by acid diffusing through it in small quantities or penetrating through it from the side and then owing to the formation of cracks loses its adherence and drops off, as a result of which a rapid solution of the steel occurs at the places in question, it is necessary to remove the metallic coating, preferably by mechanical means, for instance by brushing it off, before it develops cracks, whereby a

cutting edge is produced as shown in Fig. 5. If, after the removal of the metallic coating, it is found that the tool is not yet sufficiently sharpened, the above described operation is repeated one or more times until upon removing or brushing off the coating it is found that the necessary degree of sharpening has been attained.

For carrying out the process it is necessary to employe a solution or bath which, on the one hand, etches the tool in the desired above described manner, and, on the other hand, gives a metallic coating having the necessary properties. The bath preferably contains nitric acid as the etching means and it is advantageous to employ sulphuric acid in addition thereto. For obtaining the metallic coating on the tool salts of metals are employed which are more electropositive than iron, for example salts of copper, nickel or cobalt, either individually or in admixture with one another. It has been found that the operation of the bath is improved by the addition of neutral salts having similar ions to the acids, as, for example, potassium nitrate or Glauber salts. The presence of a depolarizer in the bath is advantageous. As a depolarizer an alkaline salt of an acid of chromium, vanadium or tungsten may, for example, be employed. The adherence of the metallic coating deposited on the tool which is under treatment is particularly dependent on the chlorine ion content of the bath. A high chlorine ion content gives a very dense adherent coating which it is difficult to brush off, whilst if no chlorine ions are present at all a very badly adherent spongy metallic coating is formed on the tool, which although it still allows of the sharpening operation necessitates very careful attention. It has been found that an addition of .1 to 1.0% of chlorine ions is advantageous in normal conditions. In the case of rough tools such as rasps the chlorine ion content may be increased to 5% without detriment. The chlorine ions may be added, for example in the form of ferric chloride or in the form of an alkaline chloride, such as common salt.

The sharpening of the tools may be carried out either in one bath or in two baths. In the first case the formation of the metallic coating and the etching of the tool, for example the file, will take place in the same bath, whereas in the second case the metallic coating is first formed in one bath and the etching operation is then carried out in the second bath, the first bath being relatively weak in acid and the second bath containing little or none of the aforesaid metallic salts, i. e., the salts of metals which are more electro-positive than iron.

The tools sharpened in the above described manner have cutters possessing a new and hitherto unknown property. As a result of the fact that the soft less valuable material has been dissolved out the surface of the tool and particularly the cutting edge is improved so that the efficiency of such a tool is substantially increased. In addition to this badly made cutters or cutters which have become blunt are improved or reinstated by the employment of the process described, whilst at the same time the quality of the material of the cutter is improved in this case also and there is very little loss of material.

The following examples serve to explain further the process according to the invention; but it is understood that the invention is not restricted to the said examples.

Example 1

Files are suspended with their tangs upwards, as shown in Fig. 1 in a bath of the following composition:

100 parts by weight of sulphuric acid
65 parts by weight of nitric acid
17 parts by weight of potassium nitrate (saltpetre)
25 parts by weight of copper sulphate (blue vitriol)
5 parts by weight of potassium bichromate
8 parts by weight of ferric chloride
780 parts by weight of water

at a temperature of 18° C. The bath which is of a greenish colour at once begins to assume a blue colour in proximity to the tools, whilst at the same time it will be seen that flakes sink to the ground and the files become covered with a coating of copper. Gas only rises to the surface of the bath to a very small extent. After about 5 to 10 minutes the tools are taken out and brushed down whilst wet, as a result of which the coating of copper is removed. If the files are not yet sufficiently sharp they are again suspended from 5 to 10 minutes in the bath, then brushed down again and so on. If the files which are to be treated have been blunted by use, the sharpening operation will be complete after about 30 to 40 minutes, so that it is necessary to suspend the files three or four times in the bath. If, on the other hand, the object of the treatment is to improve a cutting edge which is already existent, a single operation in the bath is sufficient. The files after they have been removed from the bath and brushed down are first treated with diluted lye, milk of lime or soda solution for the purpose of neutralizing any acid which may be clinging to them, and are then thoroughly washed, dried and smeared with mineral oil in order to prevent the formation of rust.

The loss of weight of a file in the sharpening operation amounts to .5 to 2%.

Instead of the 25 parts of copper sulphate 14 parts of copper sulphate and 14 parts of nickel sulphate may be employed. The final result is the same.

Example 2

(*a*) *Coppering bath.*—Thoroughly cleaned rasps are suspended with the tangs upwards in a bath of the following composition:

900 parts by weight of water
20 parts by weight of copper sulphate
40 parts by weight of sulphuric acid of 66° Bé.
40 parts by weight of ferric chloride

The tools are allowed to remain in the above bath at about 16° C. for about 5 to 10 minutes. They are then rinsed and placed in a bath of the following composition:

(*b*) *Sharpening bath.*—
1000 parts by weight of water
20 parts by weight of potassium nitrate
5 parts by weight of ammonium vanadate
100 parts by weight of sulphuric acid of 66° Bé.
100 parts by weight of nitric acid of 40° Bé.
5 parts by weight of ferric chloride
5 parts by weight of nickel sulphate

After remaining in this bath for about 10 minutes at 16° C. the rasps are removed and the copper deposit is brushed off with a wire brush, whereupon—if the rasps are not yet sufficiently sharpened—they are placed in the coppering bath again and subsequently in the sharpening bath once more, and so on until the cutting edges have obtained the highest possible degree of sharpness.

The cleansing of the tools is effected in the same manner as in Example 1 above.

We claim:

1. A process for improving and sharpening steel tools wherein a sharpening effect is produced by etching, consisting in introducing the tool into an aqueous solution of acid capable of dissolving steel, and salts of metals which are more electro-positive than iron; locating the tool in said solutions in such manner that the one face of each cutter to be etched is directed towards the bottom of the vessel containing the solution and the other face of the cutter is directed towards the surface of the solution; whereby the solution produces a metallic coating on the tool and also etches the tool; the metallic coating being formed, owing to the location of the tool, of a less dense and less adherent nature on the one face of the cutter than on the other face, so that the etching is selective and takes place more rapidly at the face having the less dense coating.

2. A process for improving and sharpening steel tools wherein a sharpening effect is produced by etching, consisting in introducing the tool into an aqueous solution of acid capable of dissolving steel, and salts of metals which are more electro-positive than iron; locating the tool in said solution in such manner that the one face of each cutter to be etched is directed towards the bottom of the vessel containing the solution and the other face of the cutter is directed towards the surface of the solution; whereby the solution produces a coating of the metal which is more electro-positive than iron on the tool and at the same time etches the tool; the metallic coating being formed, owing to the location of the tool, of a denser and more adherent nature on the face of the cutter directed towards the surface of the solution than on the other face, so that the etching is selective and takes place more rapidly at the face having the less dense coating; withdrawing the tool from the solution; removing the metallic coating from the tool; and introducing the tool into the solution again in a similar manner; whereby the formation of the metallic coating and the etching action are continued.

3. A process for improving and sharpening steel tools wherein a sharpening effect is produced by etching, consisting in introducing the tool into an aqueous solution of acid capable of dissolving steel, and salts of metals which are more electro-positive than iron; locating the tool in said solution in such manner that the one face of each cutter to be etched is directed towards the bottom of the vessel containing the solution and the other face of the cutter is directed towards the surface of the solution; whereby the solution produces a coating of the metal which is more electro-positive than iron on the tool and also etches the tool; the metallic coating being formed, owing to the location of the tool, of a denser and more adherent nature on the face of the cutter directed towards the surface of the solution than on the other face, so that the etching is selective and takes place more rapidly at the face having the less dense coating; withdrawing the tool from the solution before the metallic coating has developed cracks; removing the metallic coating mechanically from the tool; and introducing the tool into the solution again in a similar manner; whereby a new metallic coating is formed on the tool and the tool is etched again.

4. A process for improving and sharpening steel tools wherein a sharpening effect is produced by etching, consisting in introducing the tool into an aqueous solution of acid capable of dissolving steel, and salts of metals which are more electro-positive than iron; locating the tool in said solution in such manner that the one face of each cutter to be etched is directed towards the bottom of the vessel containing the solution and the other face of the cutter is directed towards the surface of the solution; whereby the solution produces a coating of the metal which is more electro-positive than iron on the tool and also etches the tool; the metallic coating being formed, owing to the location of the tool, of a denser and more adherent nature on the face of the cutter directed towards the surface of the solution than on the other face, so that the etching is selective and takes place more rapidly at the face having the less dense coating; withdrawing the tool from the solution before the metallic coating has developed cracks; removing the metallic coating from the tool by brushing it off; and introducing the tool into the bath again in a similar manner, whereby a new metallic coating is formed on the tool and the tool is etched again.

5. A process for improving and sharpening steel tools wherein a sharpening effect is produced by etching, consisting in introducing the tool into an aqueous solution of acid capable of dissolving steel and salts of metals which are more electro-positive than iron; locating the tool in the solution in such manner that the one face of each cutter to be etched is directed towards the bottom of the solution and the other face of the cutter is directed towards the surface of the solution; whereby the solution produces a coating of the metal which is more electro-positive than iron on the tool and etches the tool; the metallic coating being formed, owing to the location of the tool, of a denser and more adherent nature on the face of the cutter which is directed towards the surface of the solution than on the other face, so that the etching is selective and takes place more rapidly at the face having the less dense coating; withdrawing the tool from the solution; removing the metallic coating from the tool; introducing the tool in a similar manner into another solution containing acid capable of dissolving steel, and salts of metals more electro-positive than iron, this latter solution being of different concentration and constitution from the first-named solution; whereby a new metallic coating is formed on the tool and the tool is etched again.

6. A process for improving and sharpening steel tools wherein a sharpening effect is produced by etching, consisting in introducing the tool into a solution containing acid capable of dissolving steel and salts of metals which are more electro-positive than iron, said solution having more than .1% but less than 5% of chlorine ions; locating the tool in the said bath in such manner that the one face of each cutter to be etched is directed towards the bottom of the bath and the other face of the cutter is directed towards the surface of the bath; whereby the solution produces a metallic coating on the tool and also etches the tool; the metallic coating being formed, owing to the location of the tool, of a less dense and less adherent nature on the one face of the cutter than on the other face, so that the etching is selective and takes place more rapidly at the face having the less dense coating.

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