NEW FILES for OLD

A large engineering works may use hundreds of files in a week. In this article BARRY describes a successful electrolytic method of reclaiming worn files

I HAVE recently been engaged on the design and installation of equipment capable of re-sharpening five hundred worn files a week. Considerable experimental work had to be undertaken before a satisfactory process, capable of bulk production, could be evolved.

Among the processes tried was chemical etching, and many were the etching solutions tested. Nitric acid at varying strengths was one solution used but it was unsuccessful because the acid rapidly removed what little sharpness the old files possessed before immersion.

In a large engineering works the number of files issued from the stores in a week may be considerable. Moreover, as files are usually considered to be expendable tools no attempt is made to salvage them when worn, so the old files in due course find their way to the scrap heap.

At one engineering works an investigation into the cost of expendable tools showed that five hundred files of all types were issued in one week. It was decided: therefore, to conduct a series of experiments with a veiw to reclaiming as many'files as possible.

The re-cutting of files has engaged the attention of metal workers for many years, and methods of carrying out this re-sharpening are to be found in some of the older textbooks on workshop procedure. Most of these instructions specify the use of acid to secure the desired result.

The experiments carried out in this direction showed that acid-dipping by itself was a slow process, even if successful, which in many instances it was not and it was scarcely a practical p&position when the quantity of files to be sharpened was large. In such circumstances a process was needed that would do the work quickly, that could be handled by semi-skilled (or even unskilled) workers, and that did not need complicated or unfamiliar equipment.

A process that fulfils all these requirements is the electro-chemical cleaning of parts before they are plated; this is a process of electro-etching carried out in a solution of sulphuric acid.

In order to examine the possibilities of re-sharpening files by the method of electro-etching, experimental pilot equipment was set up. This consisted of a stoneware electrolytic bath provided with a pair of stainless-steel cathode plates and an anode bar to which files to be sharpened could be secured (Fig. 1). As well as the electrolytic vat a hot caustic soda bath was furnished to clean the files before etching together, and a hot-water tank for washing the files after treatment was also provided.

These two baths were fitted alongside the electrolytic vat. Finally, an old steel drum to hold de-watering and rust-protective fluid was placed handy to the main equipment; for it must be noted that iron and steel rust very rapidly after electro-etching.

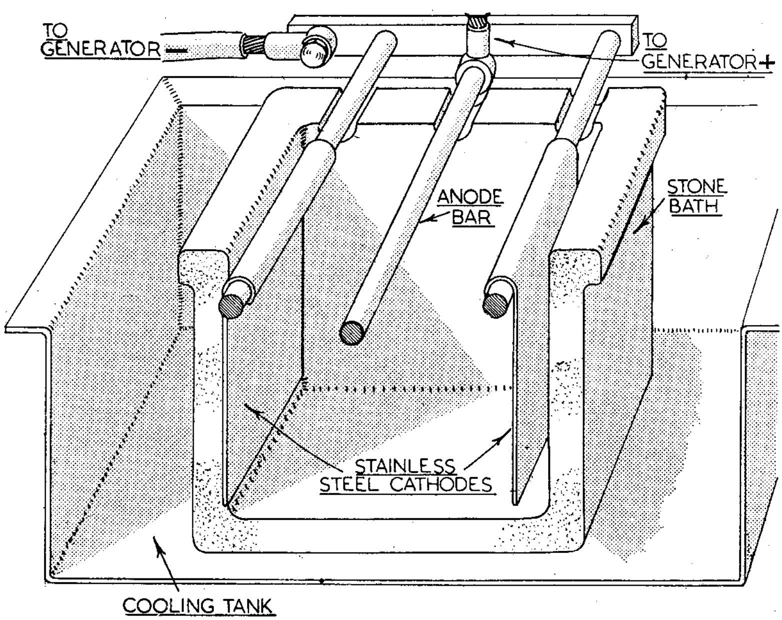
Very little was known about the required strength of the electrolyte-indeed, in the very early stages the nature of the electrolyte itself was in doubt. So much so, in fact, that the use of an incorrect solution caused the first two files that were treated to disappear almost completely ! However, it was finally discovered that sulphuric acid, normally used in the electro-chemical cleaning of tinplate, gave the best results.

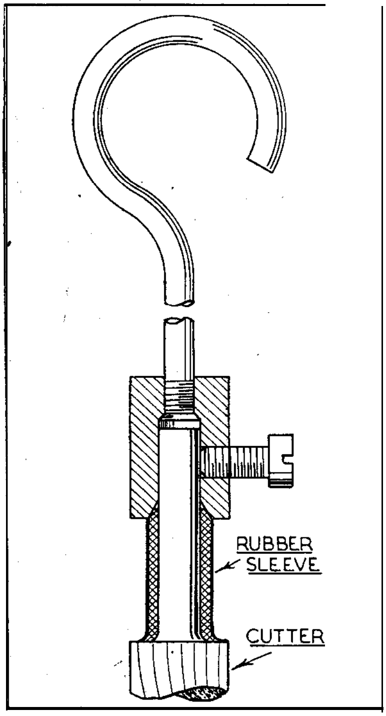
A number of files were treated and handed to the foremen of departments engaged in the shaping. of such materials as Jabroc, Perspex, glass-cloth laminate and the like. The files were given to men who could be relied on to give the tools a thorough testing and to furnish a constructive report on the performance obtained by the re-sharpening process.

The results have been most encouraging and have shown that the useful life of a file has been extended by as much as seven times. Some files have been re-sharpened three or more times with no loss of efficiency.

The electrical equipment available for carrying out the initial experiments comprised a motor generator set having an output of 1,000 amp. at 50 v. together with the necessary starting and control gear. A generator of this capacity is somewhat difficult to regulate at low output, as a result the files treated were subjected individually to a current of 100 amp. and

Fig. 1: Showing how fhe stone bath containing the anodes and cathodes is enclosed in a cooling tank





Above, Fig. 3: The rubber sleeve on this hanger protects the shank during sharpening

more. This was perhaps, fortuitous, for it quickly became clear that 10 minutes in an acid bath of 56 per cent. sulphuric acid at 100 amp. produced both the finish and degree of sharpness desired.

The file to be treated was hung from the anode bar and parallel with the cathode plates. The file was thus presented to the cathodes so that most metal was etched from the face of the tooth immediately opposite to the cathode, while the least metal was etched from the face at right angles to them. This action is illustrated diagrammatically in Fig. 2.

In addition, what appears to be the natural tendency for corners or points to become sharp under galvanic action greatly assisted the sharpening process. An example of this was provided by one file that was left for a long period in the electrolytic vat; on removal the tang of the file was found to be pointed like a sewmg needle

Initially, all files treated were totally immersed in the electrolyte. Later, when the full-scale equipment came to be designed, the files were suspended 10 at a time, each file being held by its tang in a frame so that only the blade of the file was immersed in the acid. In this way the file tangs were unaffected by the acid and so suffered no erosion likely to cause damage or make them dangerous to handle.

Cleaning the files

Before treatment the files were cleaned and this was most effectively carried out in a 15 per cent. caustic soda bath at a temperature of 80 deg. C. Such a bath does its work rapidly and will remove any light alloy " pinning " that has become imbedded in the file teeth. Clogging by stainless steel is not removed by the caustic bath but rapidly falls away in the electrolytic vat with no ill effects on the re-sharpening process.

The temperature of the acid bath was never allowed to rise above 45 deg. C. as the rate of etching increased rapidly causing pitting of the work surface. In addition, when tool steels were concerned, there was liberation of free carbon, some of which found its way to the cathode plates, though much of the carbon adhered to the surface of the files leaving a poor finish and a surface that defied all further attempts to improve it.

The experimental equipment was too small to allow cooling pipes to be fitted to the vat itself, so to keep down the temperature the vat was placed in a cold-water bath. Though this action was of some help it was not possible to hold the bath temperature at its optimum value for any length of time. Accordingly, a second vat was made having three turns of 1/2 in. lead pipe formed as a cooling coil and placed on lead supports so that the coils were in the upper part of the vat.

This has had the effect of keeping the electrolyte cool except when the ferrous sulphate, formed during the sharpening process, became excesstve ; an excess of sulphate caused the vat temperature to rise considerably and was an indication that the electrolyte needed attention. At present, renovation of the acid consists in syphoning off the old electrolyte which is allowed to stand in carboys until the ferrous sulphate has settled out; the acid above the sulphate *is* then syphoned back into the vat and made up to strength as needed.

Types of file suitable for treatment

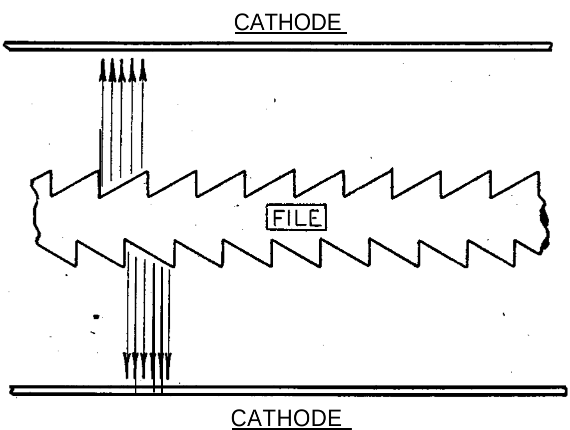
Most files can be re-sharpened by the process described, with the exception of Swiss files. This type of file responds badly to treatment, usually because of the damage sustained before being sent in for reclamation, and in this connection it should be noted that the process cannot replace file teeth that have vanished through wear.

The shape of the file appears to be no drawback; indeed all shapes have responded to treatment with equal success. The same remarks apply equally to rotary files; but it must not be expected that a perfect tool will result if the file has first been run to death. When etching rotary files experimentally the hanger seen in Fig. 3 was devised in order to protect the shank during re-sharpening.

By now readers will have gathered that carrying out the re-sharpening of files in bulk needsplenty of electrical power and proper equipment; in addition, the handling of sulphuric acid in the concentration needed calls for care and, of course, the necessary extraction apparatus to ensure an acid-free atmosphere in the shop.

However, it seems quite reasonable to suppose that, time being no object, files could as well be re-sharpened if subjected to much less current density but for a longer period. I have had no opportunity to prove this because the size of the generating set employed made an experiment on these lines out of the question.

On the other hand, those readers who have access to a laboratory or the requisite facilities might well care to try this procedure for themselves. B



Left, Fig. 2: The electrical flow actually aids the sharpening, as is illustrated here