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METHOD OF RECONDITIONING FILES

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This invention relates to a method of treating steel files to accomplish sharpening and reconditioning thereof.

The invention contemplates and has as its primary object the provision of a method of reconditioning and sharpening steel files such as to be applicable to the treatment of files either before or after being used to effect sharpening thereof and which is particularly adapted to reconditioning files after their having become oxidized, or worn, or rendered ineffective by clogging of the toothed surfaces thereof.

Another object is to provide a method of chemically treating steel files whereby various substances accumulated on the toothed surfaces of the file and which interfere with its proper use may be removed and the teeth of the file slightly etched so as to sharpen the file.

Another object is to provide a method of the above character which is extremely rapid in its action and is adapted to the treatment of files in batches to the end of enabling the attainment of a large output in a short time and whereby the reconditioning of files may be so economically effected as to render practical the commercial rejuvenation of files on a large scale.

Another object is to provide a process for chemically reconditioning and etching steel files such as not to be detrimental to the files under treatment and which consequently results in little or no loss of files because of damage thereto while processing.

A further object is to provide a file reconditioning and sharpening process embodying a step whereby the processed files will be rendered free of subsequent detrimental action of chemicals employed in the process.

Other objects and advantages will appear hereinafter.

The method constituting the subject hereof involves the employment of alkaline baths and acid baths which generally considered have been used heretofore in the cleansing of metallic surfaces particularly in removing oxides and in pickling operations, and also involves the employment of sulphuric acid and nitric acid which have long been used in chemically conditioning files. My invention while embracing these old features is characterized by the employment of certain specific consecutive steps embodying the employment of alkaline and acid baths of particular natures and in a particular fashion, together with intermediate washing operations which I have found to be essential to proper conditioning of files and which results in a product possessing a high standard of quality not subject to deterioration as the result of the acid treatment.

In setting forth my method herein the several time, temperature and strength of solution factors, together with specific substances used will be

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set forth in order to enable persons skilled in the art to carry it into effect with a high degree of efficiency, but it will be apparent that the method can be modified within limits without departing from the spirit of the invention.

In carrying out my invention the following consecutive steps are employed:

First step

The files to be treated, preferably in a batch, are first immersed in an alkali bath capable of dissolving grease, oils and fats and also capable of acting as a solvent for particles of aluminum, and which bath preferably consists of a 25 to 35% caustic soda solution. The files are boiled in this solution for such length of time as to effect removal of all particles of aluminum which may have accumulated on the files and at the same time remove at least a portion of such grease, oil and fat as may have been deposited thereon. Thirty minutes of such hot alkaline bath is ordinarily sufficient to accomplish this cleansing action. After completion of the bath, the files are removed from the solution and while hot are rinsed with a spray of cold water applied at normal temperature and at the pressures of domestic water supply systems, usually about 85 pounds, for a period of five minutes or thereabouts to effect sudden cooling of the files and their consequent contraction from their expanded condition occasioned by the action of heat in the boiling operation. This rinsing and cooling operation may also be effected by immersing the files in cold water. The expansion and contraction of the files serves to effect loosening of some material embedded in the crevices of the files due to differential in expansion and contraction of different substances.

This rinsing operation also serves to wash the files to remove loose particles therefrom and at the same time effect cleansing the files of at least the major portion of the alkali solution as may cling thereon.

Second step

The washed files are submerged in an acid bath capable of dissolving and removing any grease, oil, fat, tar, pitch and similar substances which may be present thereon after completion of the alkali and washing treatment, and also capable of removing iron oxide or rust accumulated on the file and at the same time dissolve fine particles of iron or steel and silver which may be deposited in the crevices of the file. This acid bath preferably comprises a mild solution of sulphuric acid. A five to ten per cent solution is satisfactory.

The files are immersed in this acid bath for a period of fifteen minutes or thereabouts during which time the solution is maintained at a temperature of 160° F. or approximate thereto. How-

ever, care must be exercised to avoid the bath reaching a temperature in excess of 180° F. for the reason that a temperature higher than this is liable to detrimentally affect the points of the file teeth.

This acid bath will serve to remove the substances above specified as well as others subject to being dissolved by the action of sulphuric acid of the strength and in the time stated, and will also act on removal of such substance to mildly attack the toothed surface of the file so as to effect a slight sharpening action on the ridges or teeth of the file. As a substitute for commercial sulphuric acid I have found that the product known as "Saniflush" is highly satisfactory when used in the range of proportions specified for sulphuric acid. This product comprises a mixture of sodium bisulphate, sodium chloride and magnesium silicate.

The files are removed from this acid bath when sufficiently cleansed and are rinsed in a water bath or spray for about five minutes to effect removal of loose particles from the files and also remove the sulphuric acid clinging thereto.

Some files may be adequately cleaned and reconditioned after the completion of this second step, particularly files that have become fouled by oxidization, those that have been used solely in filing aluminum, silver and steel, and such files that are coated with pigments and oily, greasy, or resinous materials, or other materials that are readily soluble in either caustic soda or weak solution of sulphuric acid. Any files that may be deemed inadequately reconditioned at the completion of this second step may be treated as set forth in the last step to be later described. However, the essence of the present invention resides in subjecting files to the hereinafter recited steps in continuation of the specified first and second steps, since the greater majority of files requiring reconditioning have dulled teeth which will not be adequately sharpened by the named alkali and acid treatments, and besides have been used in filing soft metals such as copper, brass, bronze, lead, zinc and other metals or alloys which will not be affected by the alkali and acid specified.

Third step

The files cleansed as above described are then immersed in an acid bath capable of digesting the soft metals and their alloys including copper, brass, bronze, babbit, lead and zinc, and also capable of effecting an etching or sharpening action on the teeth of the file. This acid bath preferably comprises a 7 to 10 percent solution of nitric acid.

In subjecting the files to the action of the nitric acid bath it is essential that the temperature of the solution be maintained sufficiently low as not to blister or mutilate the files. I have determined that temperatures in excess of 180° F. are liable to damage the files and accordingly it is necessary, in order to insure a high standard of quality in the reconditioned product, to treat the files in the nitric acid solution at a temperature ranging downward from 180° F. Since considerable heat is generated by the action of the nitric acid solution in digesting metallic particles on the file, especially when the solution is fresh, the temperature of the solution is regulated by subjecting the solution to the action of a cooling medium such as a refrigerant flowed through tubes submerged in the solution. The flow of the refrigerant is controlled in a conventional fashion as by an automatic thermostatic controlled feed

valve, to effect control of the temperature of the nitric acid solution and whereby the temperature of the solution may not only be maintained at not more than 180° F. but may be varied from time to time to meet varying conditions. The lower the temperature of the nitric acid solution the slower will be its action and conversely the higher its temperature the more rapid its action. There are occasions when a slow action is desirable and times when a faster action is wanted and accordingly regulation of the temperature of the solution becomes quite important in commercial reconditioning of files.

There are limitations as to the length of time the files may be treated in this bath without damage which period varies, however, as to the condition of the files under treatment and also the temperature and strength of the nitric acid solution. The lower the temperature of the solution and the weaker the solution the greater the period of time during which the files may be immersed in the solution. I have found in practice that a period of fifteen minutes of submersion of the files in the nitric acid solution of the strength above stated and at a temperature of about 160 degrees is ordinarily sufficient to accomplish removal of copper and its alloys from the files, but where babbitt or lead are to be decomposed a longer period may be required. However, whatever period is necessary to effect the requisite action, such period is preferably, though not necessarily consumed in a series of immersions of short duration, for example, of three minutes each. By so doing the extent of the action of the nitric acid may be watched from time to time so as to minimize possibility of excessive corrosive action on the files.

When by examination it is determined that the nitric acid treatment has accomplished the desired result of removing the softer metals and slightly etching the teeth of the files, the latter are again subjected to a thorough washing action by immersing and agitating in water to remove the nitric acid solution and any other substances as may be subject to removal by such washing. Water spraying of the files after treatment with nitric acid may be employed but such spraying operation ordinarily is not adequate when applied to a batch of files since impact of the spray on some of the files will act to knock acid therefrom onto other of the files therefore rendering it possible for retention of nitric acid on at least some of the files with consequent damage thereto. Even if a spraying operation be used it is necessary to follow it with immersion and agitation in a water bath in order to insure thorough removal of the nitric acid.

Fourth step

The files are then immersed in a fifty per cent solution of sulphuric acid and allowed to remain therein a period of from thirty to forty minutes whereby such metals or other materials as may have escaped the earlier sulphuric acid treatment and which are subject to decomposition or dissolution under the action of such solution will be removed. The temperature of this solution should not exceed 180° F.

Fifth step

At the conclusion of this second sulphuric acid treatment the files will be thoroughly cleansed and will be well sharpened but ordinarily files that were considerably worn will be improved by a further sharpening action. To accomplish this

the files are immersed in boiling water. This hot water treatment constitutes an important step in the process since on immersion of the acid coated files in boiling water an instant accelerated action of the acid takes place which is particularly manifested on the tips of the file teeth in increased sharpening thereof. This action is limited to such short duration as to insure against excessive etching of the points of the teeth by reason of the acid being quickly weakened by the hot water.

The files are maintained in this hot bath for a sufficient length of time to dilute the acid clinging to the files to at least near neutral. A period of five minutes or thereabouts is ordinarily adequate. The files will be thoroughly cleansed and sharpened at this stage of their treatment.

Sixth step

Immediately or shortly after removing the files from the hot water bath they are subjected to the action of a neutralizing agent, as by being submerged in a boiling alkaline bath such as to insure any acid clinging to the files being rendered neutral. This bath preferably consists of a five to ten per cent Baumé solution of sodium carbonate or a solution comprising one pound or thereabouts of pulverized sodium carbonate dissolved in fifty gallons of water, together with a one per cent solution of bichromate of soda. The files are submerged in this neutralizing solution for such length of time as to obtain the desired result. Boiling the files in this solution for ten minutes is ordinarily sufficient.

The files on being thus subjected to the hot neutralizing agent are removed therefrom and while hot are suddenly cooled by submergence in cold water in which the files are thoroughly washed. About five minutes will suffice for this treatment.

Seventh step

While the files are in condition for re-use on being dried at the conclusion of the preceding step, they are subject to becoming oxidized on exposure to air and moisture and accordingly it is vitally important in the reconditioning of the files on a commercial scale that they be given a protective coating such as to obviate rust. For this purpose the files on being finally washed in cold water at the end of the preceding step are immediately given a protective coating as by being submerged in a solution of soap and water. This solution is preferably prepared from a soap having a vegetable base such as the soap known as "Palm Olive." Four hand bars of such soap dissolved in fifty gallons of water makes a satisfactory soap solution for the purpose. The files are immersed in this soap solution long enough to insure thorough coating thereof. Merely dipping the files in the solution is ordinarily sufficient. On removing the files in the solution they are dried in atmosphere at room temperature whereupon the files will be coated with a protective film of soap whereby the file surfaces will be retained free from rust. The reconditioned product is then ready for use or for packaging or storing.

The total time required to perform all the steps of this process to and including applying the final coating, assuming no appreciable delay occurs between any of the operations, will be from two to two and one-half hours, thus greatly reducing the time ordinarily consumed in the reconditioning of files.

The process herein set forth is especially applicable to the treatment of files on a large scale, it being subject to being carried out by the employment of a series of cauldrons containing the several liquids which are arranged in the consecutive order of their use. Batches of files supported vertically in spaced relation to each other on a portable rack are conveyed to and from the several cauldrons and are lowered into and withdrawn from the baths by suitable hoisting mechanism; the files being previously classified or graded in each batch according to similar characteristics so that the files in batches needing different times of treatment may be variably treated according to requirements and so that all the files of each batch will be uniformly treated. However, it may be that at the end of any step in the process some files in a batch may not be adequately processed in which event such files may be removed from the batch at any stage in the process and be retreated with any of the steps to insure its proper reconditioning.

I claim:

1. The method of reconditioning files consisting in first subjecting the files to the action of a solvent of aluminum, grease, oils, fats, pigments and the like, washing the files, then immersing the files in a weak solution of sulphuric acid, washing the files, subjecting the files to the action of a nitric acid solution, washing the files, again immersing the files in a sulphuric acid solution stronger than that previously employed; immersing the files in boiling water whereby an instant acceleration of the action of acid clinging to the files will occur and effect a sharpening of the file teeth, immersing the files in a neutralizing bath, washing the files, and finally coating the files with a rust protective material.

2. In a process of sharpening steel files involving subjecting the files to the action of nitric acid solution to effect etching of the file teeth followed by water washing, the steps of immersing the files in a sulphuric acid solution immediately followed by immersion of the files in boiling water whereby an instant acceleration of the action of acid clinging to the files will occur and effect further and final sharpening of the file teeth.

3. In a process of sharpening steel files involving subjecting the files to the action of nitric acid solution to effect etching of the file teeth followed by water washing, the steps of immersing the files in a sulphuric acid solution immediately followed by immersion of the files in boiling water whereby an instant acceleration of the action of acid clinging to the files will occur and effect further and final sharpening of the file teeth, then immersing the files in a neutralizing alkaline bath.

4. In a process of sharpening steel files, the steps consisting in immersing the files in a seven to ten per cent solution of nitric acid, for a period of fifteen minutes, to sharpen the teeth of the files, removing excess heat from the solution occasioned by reaction of the acid on the files by means of a refrigerant to maintain the temperature of the solution below 130° F. during immersion of the files, then water washing the files, then immersing the files in a solution of sulphuric acid then immediately immersing the files in boiling water to effect further sharpening of the teeth of the files, and thereafter subjecting the files to an acid neutralizing treatment.

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