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METHOD OF DE-SCALING OF METALS BY PICKLING

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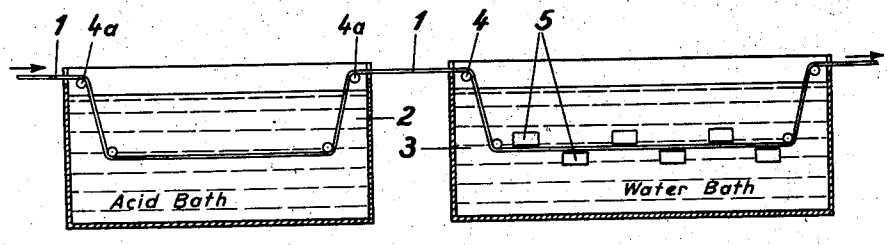


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# METHOD OF DE-SCALING OF METALS BY PICKLING

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6 Claims. (Cl. 134—1)

The present invention relates to a method of de-scaling metals by pickling. The heretofore known methods of de-scaling metals by pickling have the well-known drawback that practically the entire scale to be pickled off is dissolved in the pickling acid which, therefore, has to be renewed or regenerated after a relatively short time. Furthermore, with the heretofore known methods of de-scaling by pickling, the de-scaling operation requires a relatively long time.

It is, therefore, an object of this invention to provide a method of de-scaling metals by pickling, which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a method of de-scaling metals by pickling which will considerably reduce the de-scaling time over the time heretofore required in similar circumstances.

It is a still further object of this invention to provide a method of de-scaling metals by pickling, which will considerably extend the useful life of the pickling bath before a renewal or regeneration of the bath becomes necessary.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing diagrammatically showing a section through an arrangement according to the invention.

According to the present invention, an acceleration of the de-scaling of metals is obtained by subjecting the metal, which is to be de-scaled in a liquid bath to sound or ultrasound oscillations of such high energy that cavitation occurs. By "cavitation" is meant the phenomenon that the oscillating liquid is torn open by the tensile stresses arising in the oscillating liquid whereby, when the caves which have been formed close again, considerable mechanical forces arise.

It has been found that the maximum acceleration of the de-scaling operation by means of sound or ultrasound oscillations can be obtained only when the oscillations bring about the occurrence of cavitation. Cavitation in water will occur for instance when the sound energy acting upon the insonated body amounts to approximately 2 watts per square centimeter or more.

According to the invention, the treatment with sound or ultrasound (insonation) can be carried out while the metal is in the pickling bath. This embodiment of the invention, however, requires special steps or the employment of special materials in order to prevent the sound emitters or sound heads from being damaged by the pickling liquid. For this and other reasons, it is particularly advantageous, according to the invention, to place the metal to be de-scaled first into a de-scaling bath without subjecting the metal to insonation while leaving the metal in said pickling bath only long enough to bring about a loosening of the scale layer. In other words the metal does not remain long enough in the pickling bath to free the metal from scale. After the pickling bath has brought about a loosening of the scale, the metal which is still covered with scale is removed from said pickling



bath and placed into another liquid bath which may consist for instance of water. It is in this liquid bath that the metal is then subjected to the action of sound or ultrasound, and this insonation brings about a removal of the scale from the metal in a very short time. It should be noted in this connection that the said bath does not have to bring about any chemical reaction but serves merely to transmit the sound waves for the respective emitter to the respective metal. The sound waves remove from the metal the scale previously loosened in the pickling bath. Consequently, with this method, the sound emitters or sound heads are not exposed to the corrosive attack of the pickling liquid which facilitates and simplifies the construction of said sound emitters or sound heads.

The method according to the invention may be carried out by means of the arrangement shown in the drawing in which the reference numeral 1 designates a metallic band to be de-scaled. As will be seen from the drawing, the metal band 1 passes over rollers 4*a* through the pickling or acid bath 2 while the time during which the band 1 is subjected to the influence of the bath 2 may only be one-fourth or one-third of the normal pickling time, i.e. the pickling time normally employed with the heretofore known methods. The band 1 which is still not free from scale then passes from the acid bath 2 into the water bath 3 where it passes over the rollers 4 while it is subjected to insonation by the sound emitters or sound heads 5 to such an extent that cavitation occurs. Due to the action of this sound energy, scale is removed from the metal to be de-scaled in a very short time.

The sound emitters 5 for producing the sound or ultrasound waves to act upon the metal band to be de-scaled are preferably so arranged that the band 1 passes therebetween and is insonated alternately once from one side and the next time from the other side. This type of insonation has proved particularly favorable because also on that side of the band which is remote from the sound emitter, already a considerable separation of scale from the metal occurs while the thus precleaned side of the metal band, when at the next sound emitter being directly exposed to the effect of the latter, will be cleaned still more effectively. The distance between the object to be de-scaled from the respective sound emitter should be as small as possible. The power measured on the insonated object during the insonation may be approximately 2 to 3 watts per square centimeter.

Due to the short period pickling of the material to be de-scaled prior to the insonation, the scale is only partially dissolved in the acid and to the major extent is loosened only so that the scale can be quickly and completely removed by the insonation. If, for instance, with a sheet metal, a normal pickling time of from 10 to 15 minutes is carried out in a 10% sulfuric acid with a bath temperature of 50 to 60° centigrade, such metal need, according to the present invention, be pickled only for 2 to 4 minutes. Thereupon the insonation is carried out in the water container and causes the separation of the scale, for instance in approximately 10 to 15 seconds.

Due to the method according to the invention, the acid consumption can be reduced by approximately 40%. This is due primarily to the fact that a considerably smaller quantity of the scale is dissolved in the pickling liquid than is the case with the heretofore customary pickling method. The reduced consumption of pickling bath represents in itself not only an important advantage but is also highly advantageous because less costs are involved for the neutralization or regeneration of the consumed acid.

It is, of course, understood that the present invention is, by no means, limited to the specific method described and arrangement shown in the drawing but also comprises

any modifications within the scope of the appended claims.

What I claim is:

1. A method of de-scaling metals, which includes the steps of: treating the metal to be de-scaled in an acid pickling bath for a period sufficient only for loosening the scale without completely removing same from said metal, transferring the thus pretreated metal from said pickling bath into a water bath, and treating the metal in said last mentioned bath by the action of cavitation caused by sound waves the energy of which measured on the metal to be de-scaled amounts to at least 2 watts per square centimeter.

2. A method of de-scaling metals, which includes the steps of: subjecting the metal to be de-scaled to the action of an acid pickling bath for a period sufficient only for loosening the scale without completely transferring same from said metal, removing the thus pretreated metal from said pickling bath into a water bath, and treating the metal in said last mentioned bath by the action of waves of the frequency range extending from the lower frequency limits of sound waves to the upper frequency limits of ultra sound waves, the energy of said sound waves measured on the metal to be de-scaled amounting to at least 2 watts per square centimeter.

3. A method of de-scaling metals, which includes the steps of: placing the metal to be de-scaled into an acid pickling bath for a period sufficient only for loosening the scale without completely removing same from said metal, removing the thus pretreated metal from the acid pickling bath and placing the same into a liquid bath adapted to transmit the waves of sound emitters to the said metal while being substantially inert to said sound emitters and to said metal, and removing the scale from the metal in said last mentioned bath by the action of cavitation caused by sound waves, the energy of which measured on the metal to be de-scaled amounting to at least 2 watts per square centimeter.

4. A method according to claim 3, in which the scale is removed from the metal by the action of cavitation caused by ultra sound waves.



5. A method of de-scaling metals, which includes the steps of: treating the metal to be de-scaled in an acid pickling bath for a period sufficient only for loosening the scale without completely removing same from said metal, transferring the thus pretreated metal from said pickling bath into a liquid bath and subjecting the metal to be de-scaled in said liquid bath to sound waves produced by sound emitters the energy of which measured on the metal to be de-scaled amounts to at least two watts per square centimeter, while causing the sound waves to act upon the metal to be de-scaled successively from one side and from the opposite side, said liquid bath being substantially inert to said sound emitters and to said metal.

6. A method of de-scaling metals, which includes the steps of treating the metal to be de-scaled in an acid pickling bath for a period sufficient only for loosening the scale without completely removing same from said metal, transferring the thus pretreated metal from said pickling bath into a liquid bath adapted to transmit sound waves and ultra sound waves, and treating the metal to be de-scaled in said liquid bath by the action of cavitation produced by sound emitters the energy of which measured on the metal to be de-scaled amounts to at least two watts per square centimeter, said liquid bath being substantially inert to said sound emitters and to said metal.

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