PROCESS OF BONDING KNIFE BLADES WITHIN HANDLES

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ABSTRACT OF THE DISCLOSURE

Process for bonding knife blades within handles with a view to minimizing corrosion, which process comprises introducing a mixture of magnesium oxide and magnesium nitrate into a recess of the handle and then introducing the blade into the recess, whereby the nitrate having a corrosion inhibiting effect is present in an amount of at least 20% by weight based on the dry state of the water-soluble constituent of the cement, the mixture being subsequently heated to a temperature ranging from 70° to 95° C. to set and harden it.

The invention relates to the manufacture of a durable and corrosion-resistant bonding of blades within handles and relates particularly to the bonding of knife blades within the handle of table knives.

For the bonding of knife blades within handles the cutlery industry at the moment uses low-melting alloys, almost exclusively of lead-antimony-tin. The disadvantage of this lead alloy bonding lies in the plasticity of the alloy. Through constant impact and vibration strains, the blade becomes frequently loosened from the lead alloy. In cleansing processes, the cleansing solution is drawn into the capillary cracks so formed and becomes expelled during heating. Since the introduction of fully automatic washing machines with their mechanical vibration, these results have increased greatly and have led to numerous undesirable complaints. Moreover, this lead bonding requires comparatively expensive and relatively difficult operations. The leaded handles must first be filled, shaped and tinned before bonding with the lead, which can be effected with the required precision only by a skilled expert. On account of these disadvantages of this manner of attaching with lead masses, attempts have already been made to bond blades using self-hardening synthetic resin adhesives. The process is however expensive and is not simple in application because it does not avoid the eaking of the hardened resin on the outside of the handles which must be removed to allow subsequent silver plating and can be mechanically scraped which necessitates a further operation which is in general undesirable.

The main object of the invention is to inhibit corrosion in knife, fork and spoon, especially in table knives.

It is a further object of this invention to make use of a better method which consists in adhering the blade to the handle with a cement mixture.

A further object of the invention is the use of a concentrated aqueous pasty mass of magnesium oxide and magnesium nitrate or a dry mixture of magnesia and magnesium nitrate which is mixed with a proper amount of water, combining the blade with the handle of a knife within the paste so formed and setting the paste so formed after some hours into a solid marble-like mass.

Yet another object is to minimize or overcome corrosion effects in an assembly of a blade and a handle, especially a blade in the handle of a table knife.

Further and other objects and features of the invention will be apparent from the following detailed description and the examples.

If alkaline calcined magnesite (MgCO₃) which was converted into magnesia, MgO, by being heated at 800° C. is mixed with a concentrated aqueous solution of magnesium nitrate or a dry mixture of magnesia and magnesium nitrate is mixed with a corresponding amount of water, the paste so formed after some hours into a solid marble-like mass. In the hardening process the magnesium oxide extract the water from the magnesium nitrate lye to form magnesium hydroxide or a hydrated magnesium oxide which absorbs the magnesium nitrate. In the hardened magnesia cement mixture the water-soluble magnesium salt obviously forms a chemical binding material so that none of the salt is washed away during treatment with water, with the result that e.g., during washing in which small quantities of moisture may be forced into cracks, if any, between the blade and the handle, free nitrate ions could never be removed from the magnesium nitrate cement. The result is that no serious corrosion, e.g., rusting in the cracks and surrounding metal occurs, as is known in common practice using electrolytes that affect passive, i.e. corrosion resistant chrome-steel, which is usually employed for stainless knife blades, in a potential-reducing and therefore depassivating way, as it is the case when it contains small amounts of chloride or sulphate ions. The invention is especially effective with the increasing use of automatic washing devices. Since the cleaning power of such machines is in many cases not satisfactory, one is forced to use harsher chemical compounds to emulsify the fat residues and to dissolve starch and egg albumin residues. The result is an extreme removal of fats from the washed articles and the formation of cracks between the blade and the handle. Though this measure is attractive from the standpoint of hygiene, it is on the other hand quite unsuitable, in view of its effect on the resistance to corrosion of stainless knives.

When freed from a protective grease film, depassivating substances are able to attack in even the lowest concentration and with the greatest probability. The magnesia-sulphate cement previously used with good results is therefore no longer adequate for the more stringent requirements in force.

It has now been found that the previous disadvantages can be overcome and a corrosion resistant attachment of the blade to the handle can be achieved, especially with table knives, by bonding the blade with a magnesia cement mixture, which contains, as a component having a passivating effect on stainless steel, soluble nitrates in a proportion of at least 20% by weight based on the dry state of the water soluble constituents of the cement mixture, the mixture being heated subsequently to set and harden it, preferably to a temperature ranging from 70° to 95° C.

It is advantageous that the components of the cement mixture taking part in the binding reaction should be exclusively magnesium oxide and magnesium nitrate. The proportions of magnesium oxide to magnesium nitrate in the mixture are preferably chosen from 30:70 to 70:30.

It is already known that caustically burnt magnesia with various sulphates or chlorides binds water soluble magnesium salts. It is also known that nitric acid or acid nitrate solutions increase the potential of or passivate refined steel. Pure aqueous solutions of magnesium nitrate have a pH of about 5. In a mixture containing magnesium
3 hydroxide this rises to a pH of 7, as the magnesium hydroxide hinders the hydrolytic decomposition of the magnesium nitrate by virtue of its basic properties.

Since in neutral nitrate solutions passivation is not necessary, it must be regarded as very surprising that the nitrate component can be incorporated during the steel manufacture, without corrosion beginning. It was not to be foreseen that the corrosion caused through the use of magnesium sulphate cement could be avoided by the addition of magnesium nitrate. It could not be expected that the described corrosion of the cracks could be noticeably reduced when 20% of the magnesium chloride or magnesium sulphate in such a cement were replaced by magnesium nitrate and could be completely prevented by replacing 50%. Moreover it has been found that the strength of the pure bound magnesium-magnesium nitrate mixture described is completely satisfactory for binding blades to the handles of table knives.

A conventional cement having a magnesium oxide base can be used as the magnesium cement. The magnesium sulphate or magnesium chloride customarily contained in the cement can be replaced to a limited extent in the process according to the invention by magnesium nitrate or an alkali metal nitrate.

The need for increased bulk can be satisfied by the use of the usual additives, e.g. quartz sand, pigments, and even plastics materials and the like. This mixture can be inserted, according to the invention, into the cleaned handle without special steps and the blade inserted carefully with pressure and the binding and setting of the mass can be achieved by immersion in a water bath for a period of time ranging from 30 to 60 minutes. Surplus cement over the outside of the handle is removed simply by wiping the handle clean. The danger of damaging the handle through mechanical cleaning is therefore avoided.

The particular advantage of the process according to the invention consists especially in the use of a particular cement to inhibit corrosion and rusting in the angle and cracks between the blade and the handle by virtue of the chemical properties of said cement. The bond of the blade to the handle, when accomplished by practicing the process according to the invention, is very strong in contrast to that of blades adhered by means of low-melting lead alloys. Moreover, the strength of the bond achieved by practicing the process according to the invention is not reduced even by the very intensive strains caused by machine washing.

EXAMPLE 1

550 g. of magnesium oxide (caustically burned magnesium) and 450 g. of magnesium nitrate (crystallised with 6 molecules of water) were mixed to homogeneity in a high-speed agitator and mixed with about 100 g. of water. A castable paste formed. This was put into handles cleaned by sand-blasting, up to the upper edges of the handles which were mounted in a support. Afterwards, the blades were inserted and bonded into the handle with a jig device. Excess cement was removed from the outside of the handles by wiping and the blades were properly aligned. The whole apparatus was heated in a water bath at a temperature of about 70° C. for about 40 minutes. In that time the mass set and hardened. After that time the apparatus was removed from the water bath and allowed to stand at room temperature for about 2 hours. Afterwards the finished knives were removed from the support. The surface of the blades were subsequently ground down.

The breaking strength which was needed to pull a cast-in blade from the handle was 350 kg.

The handles can subsequently be finished in the usual way, e.g. by silver-plating.

4 EXAMPLE 2

Operation was carried out according to Example 1, but the cement used had the following composition:

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\begin{align*}
\text{MgO} & \quad 500 \\
\text{MgSO}_4 & \quad 250 \\
\text{KNO}_3 & \quad 250
\end{align*}
\]

and the temperature of the water bath in which the setting reaction was effected was in the range from 90° to 95° C.

The blades secured according to this example also displayed a high strength which was not even reduced after long intensive strain.

For testing the corrosion resistance the knives are shortly boiled in tap water with the optional addition of cleaning agent containing 0.5% by weight of a commercial detergent and then allowed to cool down to room temperature. Then, after a treatment over a period of 24 hours, the knives adhered to a handle with a cement containing sulfate ions and dried, after a period of 1 to 2 hours, show strong corrosive effects, while the knives bonded with a cement containing a mixture of magnesium and magnesium nitrate even after a period of 50 hours do not show any corrosion.

Also the process of the invention has been described primarily for its effectiveness as for adhering a blade to the handle of a table knife, a great many other applications are also possible. Such applications include adhering a blade to a handle of a fork, a spoon, and the like articles.

We claim:

1. A process for minimizing corrosion in the adhering of a knife blade to a handle, especially the blades in the handles of table knives, which comprises introducing a magnesium oxide and a magnesium nitrate cement mixture into a recess in a blade handle, into which a knife blade is subsequently inserted, which cement mixture contains as a component having a passivating corrosion inhibiting effect on stainless steel, soluble nitrates in the proportion of at least 20% by weight based on the dry state of the water soluble constituents of the cement mixture, and heating the mixture subsequently to a temperature ranging from 70° to 95° C. to set and harden it.

2. A process for overcoming corrosion in the assembly of a blade and a handle, especially a blade in the handle of a table knife, wherein the blade is inserted in a recess of the handle which recess is filled with a cement mixture consisting exclusively of magnesium oxide and magnesium nitrate, the components of said mixture taking part in the binding reaction, the assembly being subsequently heated to a temperature ranging from 70° to 95° C. to set and harden it.

3. The process of claim 2, wherein said components of the cement mixture taking part in the binding reaction consisting exclusively of magnesium oxide and magnesium nitrate, are used in a proportion by weight of magnesium oxide to magnesium nitrate in the range from 30:70 to 70:30.

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