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PROCESS FOR PRODUCTION OF DIFFUSED LAYERS ON METALS.

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This invention relates to a process for the production of diffused layers on metals.

Various processes have become known for the production of diffused fire—and corrosion—resistant layers of aluminium upon metals such as iron, copper and the like. Such diffused layers are, as is well known, produced by embedding the piece to be improved in a powder of aluminium or aluminium alloys and submitting same to a treatment similar to case-hardening, at temperatures lying between 700 and 1200° C., the preferred temperature being about 1100° C. Ammonium chloride and inert substances such as sand, clay and the like are frequently also admixed with the hardening powder. Useful diffused layers can thus be obtained by means of the hitherto known processes.

The present invention relates to a further development of this process. It has been found that the quality of the protective layer produced can be considerably improved if the metallic aluminium content of the hardening powder is kept within certain definite limits. These limits lie between 15 and 30% of metallic aluminium. The most favourable content generally lies in the vicinity of 20%. Alterations of and deviations from this optimum can be caused by the temperature of treatment, the thickness of the protective layer produced and particular qualities demanded therefrom, the composition and quality of the material to be improved and the like. If aluminium alloy powders are employed the aforesaid values can be adjusted to correspond to the aluminium content of the alloy in such a manner that the amount of the alloy is calculated on its aluminium content. The hardening powders used according to the invention must obviously exhibit as uniform a dispersion of the aluminium as possible, since the aluminium concentration would be altered by irregularities in the distribution of the aluminium.

In order to ensure this uniformity during all operating conditions, the powders are preferably produced by first adding the aluminium in small amounts up to 8% to the inert base mass consisting of clay, alumina and the like. This mixture is then preferably ignited in an inert atmosphere (in order to reduce waste by the aluminium burning) and after renewed addition of aluminium within the same limits, it is submitted to the same treatment, these operations being continued until the desired aluminium content is obtained. This method of operation has proved especially advantageous owing to the fact that when larger amounts of aluminium than those above mentioned are added to the inert material it may occur that the individual aluminium particles agglomerate and thus render it impossible to produce a hardening powder of uniform distribution.

In the case of an addition within the limits above set forth, the aluminium need not be added in a very finely subdivided form but it is sufficient if it is employed in the form of chips, such as are obtained in works.

On heating to the above mentioned temperatures, the aluminium shows a marked tendency to diffuse. It disseminates very finely and uniformly in the base mass.

In order to obtain a hardening powder containing about 20% aluminium, starting from pure alumina, the aluminium is added in three stages, heating to the aforesaid temperature being effected at each stage. It is preferable to employ such base masses as already contain a certain amount of aluminium. Aluminium scrap obtained in aluminium foundries, contain aluminium in a sufficiently fine form and in amounts of 10 to 15%. If these are ground and worked up so as to separate the coarser particles, a starting material which is very suitable for the production of hardening powders can be obtained.

In continuous operations the powder can always be employed over again. It is only necessary to make up the metallic aluminium lost by the powder during the diffusion treatment, by the addition of aluminium or aluminium alloys. In the case of relatively high losses of aluminium (above 8%) this is effected in the above-described manner. If the loss is less, it is sufficient merely to admix a corresponding amount of aluminium with the powder, as uniformly as possible.

The process of the invention has the advantage that the protective layer upon the treated metal is extremely uniform and clean. Cracks and roughenings in the surface, which, as is well known, occasionally occur in other processes, are entirely avoided. The surface is relatively smooth and the increase in volume occurs so uniformly that in the case of pieces to be subsequently worked up, the work of grinding is considerably reduced. Moreover the diffusion process itself, has the advantage that it is considerably shortened and simplified.

The advantages of the above-described

process can moreover be increased by adding to the hardening powder certain small amounts of ammonium carbonate and iron-ammonium-chloride. These substances have been found to be considerably more favourable then aluminium chloride.

The most diverse substances and even metal powders such as iron filings, can be employed as inert substances, all that is necessary is that these are relatively finely subdivided and that they do not react, or do not react to any substantial extent, with the metal of the powder or with the piece to be treated.

In special cases the lower limit of the metallic aluminium content the hardening powder may be advantageously diminished to approximately 8%. In consequence thereof it may happen that the heat resistance of the treated metals will be somewhat lowered, but on the other hand there will be the advantage that the produced protective layers will be of higher ductility and that the working of the treated pieces will be considerably improved.

The ductility of the produced protective layers may be regulated by varying the content of free metallic aluminium in the hardening powder. A regulation of the behaviour of the protective layers, although in a smaller limit, may also be obtained by applying the same variations to the hardening powders with higher contents of aluminium (15 to 30%).

What I claim is:

1. Process for the production of diffused protective layers upon iron which comprises heating the iron with a powder composition containing from 8 to 30% of free metallic aluminium.

2. Process for the production of diffused protective layers upon iron which comprises heating the iron at about 1100° C. with a powder composition containing from 8 to 30% of free metallic aluminium.

3. Process of making a powder composition for the production of protective layers on metallic iron which comprises admixing with an inert material finely divided metallic aluminium in amounts up to 8%, igniting the mixture in an inert atmosphere at a temperature of from 700° to 1200° C. and repeating the addition of aluminium and the ignition until the desired quantity of metallic aluminium up to 30% is obtained in the powder.

In testimony whereof I affix my signature.

DR. EMIL LAY.