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PROCESS FOR THE TREATMENTS PERFORMED WITH GASIFORM CORROSIVE FLUIDS CHIEFLY ADAPTED FOR TEXTILE, PAPER AND THE LIKE INDUSTRIES

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The invention relates to a process for the treatment of cellulosic and like fiber materials executed by means of gaseous corrosive fluids and it has for its object chiefly to protect simultaneously those parts of the treating machines used, which are made of ferrous or metals subject to corrosive action by the treating fluids.

As such treatments may be mentioned by way of example the bleaching of cotton, rayon or like fabrics made of cellulosic fibres. Said treatment may be executed advantageously by means of chlorite which may be in the present state of technique in the form of a hot solution or of a cold solution, the product to be treated impregnated with said solution being then exposed to the action of an acid in an atmosphere of moist steam.

The bleaching treatment executed in accordance with the above disclosed technique provides excellent results as far as the actual bleaching operation is concerned but it shows serious side effects and drawbacks consisting in that the fluid evolved during the treatment attacks energetically all machine parts made of ferrous or made of metal subject to corrosion, and consequently the machinery employed must be manufactured from stainless steel containing large proportions of molybdenum and provided with a suitable protective coating. These circumstances lead to such expensive machines that the bleaching performed by means of chlorite has not found any acclaim in practice in spite of excellent results which may be obtained.

The method according to the invention which allows removing the above mentioned drawbacks is characterized by the fact that the product to be treated is impregnated with one or more treating agents in a liquid state, and at a temperature which is so low that detrimental reactions are avoided while the actual treatment is preformed by bringing the treating agent or agents to a raised temperature inside a dry atmosphere so as to form a dry gaseous fluid which may be a vapor or a gas.

According to further feature of my invention, the product to be treated previously impregnated with one or more liquid treating agents is caused to pass through a treating chamber where it is exposed within a dry atmosphere to the application of heat so that the impregnation agent or agents are brought to their boiling temperature, are then evaporated and transformed into a super-heated vaporized fluid.

According to a further feature of my invention, the product to be treated previously impregnated with a treating agent is exposed, inside a treating chamber in which prevails a dry atmosphere, to the action of at least one treating agent and to an application of heat such that the treating agents and/or corrosive compounds contained therein are transformed into a dry fluid.

According to a still further feature of my invention, the application of heat intended for the transformation of the treating agent or agents into a dry gaseous fluid is ensured by subjecting the product to be treated within the treating chamber to the action of superheated steam.

According to a still further feature of my invention, the superheated steam enters preferably the treating chamber in the form of individual jets the speed of which is greater than 5 metres per second, the jets of superheated steam having a temperature above 105° C.

According to a further feature of the invention relating more particularly to the bleaching of fibres made of cotton, rayon or like cellulosic material, the product to be treated is impregnated with a solution of chlorite and it is then exposed within a heating chamber both to the action of an activating agent such as formic, hydrochloric, acetic or like acid and to the action of superheated steam flowing rapidly through said chamber.

According to a still further feature of the invention, the product to be bleached is impregnated with a solution of chlorite containing, for example, 5 grams of chlorite per litre, or even less, the said solution being kept at a temperature of 20° C., after which the product is squeezed inside a foulard so as to lower the amount of impregnating agent to about 90% of the dry weight of the treated product, the squeezed or pressed product being finally exposed inside a treating chamber to jets of superheated steam the temperature of which is higher than 105° C. while formic acid is being sprayed over the product, during said exposure or previously thereto, at the rate of about 6 litres of formic acid per hour.

Further features and advantages of the invention will appear upon reading of the following description. As already disclosed, the application of certain treatments executed by means of corrosion producing fluids, is hindered by the corrosive action of the said fluids on ferrous and like metals of the treating machines which are being used. Among such treatments, the bleaching with chlorite has already been mentioned. Now, applicant has found that this corrosive action of the treating fluids on ferrous and like metals appears only in a hot and moist atmosphere.

The method according to the invention which is based on said discovery, removes the drawbacks referred to by incorporating the basic treating agent at a temperature which is so low that all detrimental reactions, such as corrosion of metallic parts, decomposition of treating agents or others, are avoided, and by executing the actual treatment inside a dry atmosphere through the admission of an amount of heat such that the treatment agent is brought into the state of a dry gaseous fluid which may be a vapor or a gas, i.e. no moisture remaining then inside the treating chamber. It has been found in practice that under such conditions, the attack of metals by gaseous treating agents is completely avoided.

The heat required for the execution of the above method is preferably performed by means of superheated steam devoid of any moisture, the latent heat of said superheated steam allowing for the incorporation of a large amount of heat within a unit of time.

During treatment, the impregnated liquid in the product to be treated is evaporated, and the amount of heat applied and the temperature should be such that the impregnating agent may be brought to its boiling temperature, is thus evaporated and finally superheated.

In certain treatments of the type referred to, the product to be treated may be submitted to the action of various treating agents or compounds thereof which are to be set in contact with the product to be treated under different conditions. Thus, e.g., the product to be treated may be impregnated with a liquid treating agent at room temperature and then exposed, inside a treating chamber filled with a dry atmosphere, simultaneously to the application of heat and to the action of at least one other treating agent admitted directly inside the said treating chamber in any suitable form, the application of heat having a value such that the treating agents and/or cor-

rosive compounds contained in the latter may be brought into the state of a dry gaseous fluid, such as vapor or a gas.

When the application of heat is made by means of the admission of superheated steam flowing at a high speed inside a closed circuit, and when the treating agent entering directly the treating chamber is in a liquid state, the said agent may be incorporated in the form of fine droplets so as to come into contact with the treated product, in the state of a superheated vapor.

By way of example, I will disclose hereinafter the application of the method according to my invention to the bleaching of a cotton fabric by means of chlorite.

According to my invention, the fabric weighing e.g. 250 grams per square meter, is impregnated with a solution of chlorite containing 10 grams per litre by passing through a vat containing the said solution and maintained at room temperature, i.e., about 20° C. However the ratio of chlorite is not limited to 10 grams per liter. In certain cases good results may be obtained with a ratio of 5 grams of chlorite per litre only, and in the bleaching of artificial fibres the ratio of chlorite may be reduced to 1 gram per litre.

After it has passed through the said vat, the fabric is squeezed in a wringing foulard in a manner such that the amount of impregnating liquid may be reduced to about 90% in weight of the dry fabric, after which the fabric is submitted to the action of formic acid or of like agent producing the same effect just before it enters the treating chamber. The incorporation of formic acid may be executed either through passage of the fabric inside a bath preferably of a reduced volume, or else through projection of formic acid as a spray of droplets on the surfaces of the product, or again in any other suitable manner. Possibly, the application of formic acid may be actually executed inside the treating chamber.

This being done, the fabric is caused to pass through a treating machine designed e.g. after the manner of drying machines and incorporating a heat-insulated chamber containing at either side of the path followed by the fabric, series of nozzles through which it is possible to drive onto both surfaces of the fabric a gaseous fluid conveying the heat. According to the invention, the heat conveying fluid used is constituted by superheated steam at a temperature preferably above 105° C. and flowing through a closed circuit incorporating reheating means, the flow of superheated steam being preferably above 5 meters per second.

Since such agents used in the bleaching treatment are toxic for human beings, the treating machine should be provided with means allowing the fluidtight input and output of the product to be treated and the exhaust of any excess fluid produced inside the machine during the treatment.

The equipment of the treating machine referred to hereinabove is within reach of conventional technique relating to such treating machines for textile and like product and requires no further detailed description.

Before the fabric enters the treating chamber, the latter is brought, by means of an admission of superheated steam, to a temperature sufficiently above 100° C. in order to prevent any condensation on the walls or like structural elements. The steam admitted before the actual treatment has begun also drives out any air heretofore contained in the machine so that the latter is filled practically only with superheated steam (constituting a dry atmosphere) before the treatment begins.

The impregnated fabric containing as disclosed hereinabove 90% of its own dry weight, a solution of chlorite and furthermore some formic acid enters the treating chamber prepared as described and is submitted therein to the action of jets of superheated steam projected against both its surfaces at a high speed, say, above 5 meters per second. The formic acid leads to the production of

chlorine dioxide (ClO_2) the presence of which in the fabric produces immediately the desired bleaching effect.

According to a chief feature of the invention, the actual treatment is thus performed inside a dry atmosphere, i.e. inside an atmosphere constituted by superheated steam and the incorporation of heat produced by the superheated steam is furthermore increased to such an extent that any impregnating liquid still contained in the fed fabric is brought to its boiling point and is evaporated, while any gaseous fluid existing in or formed inside the treating chamber is brought to a dry state, i.e. to the state of a dry or of dry superheated vapor. Thus any excess solution of chlorite is brought to the boiling point and evaporated and gaseous chlorine dioxide formed through reaction between the chlorite and the formic acid is brought to superheated condition through said application of heat.

It should be remarked that such conditions are quite different from those obtained hitherto in any known bleaching treatment according to which bleaching reaction is performed either inside a hot solution or in a hot and moist atmosphere constituted generally by saturated steam.

In the bleaching treatment disclosed hereinabove, the chlorine dioxide is resorted to although in the prior known methods the same exerts an energetic corrosive action on ferrous metal parts inside the treating chamber. As already disclosed hereinabove, applicant has found that this corrosive action of chlorine dioxide was caused due to the simultaneous presence of moisture. Consequently, in the method according to the invention defined hereinabove, and according to which the operation is executed in a dry atmosphere, through the action of dry gaseous fluids, said corrosive action is eliminated and consequently, the novel bleaching method may be executed in a treating machine made of standard ferrous or like metals subject to corrosion.

The particular conditions of operation of the method according to my invention with a view to avoiding corrosive action of the gaseous fluids resorted to, reduce by no means the efficiency of the bleaching treatment itself and allow the attainment of excellent results which lead to the fact that the fabric thus treated leaves the treating machine after a few seconds only and in a state of perfect whiteness. At the same time, the water-absorbing properties of the fabric are improved and any motes remaining or foreign matter still in the fabric after the preliminary scalding are completely destroyed.

Of course, the modus operandi of the method according to my invention is disclosed solely by way of a mere exemplification and by no means in a limiting sense and it is possible to modify in any suitable manner the operative steps without thereby unduly widening or changing the scope of the invention. Thus the method is not only applicable to bleaching but also to any other treatment executed through the use or formation of moist corrosive gaseous fluid. The superheated steam forming the heat-conveying vehicle to be preferred may be admitted directly as it is inside the treating chamber or else it may be merely formed in the latter through the superheating of steam admitted in a saturated state inside said chamber. Furthermore, the superheated steam may be admixed with further gaseous fluids in any desired proportion according to the treatment to be executed.

The treating machine to be used may include any arrangement required for the contemplated treatment.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. The process of bleaching a fibrous product in a treatment machine in which ferrous metal parts thereof are exposed to corrosion by gaseous chlorine dioxide

evolved from an impregnating solution of chlorite at a concentration of at least 1 gram per liter with which the fibrous product has been imbued; said process comprising the steps of applying to the surface of said product an activating agent capable of reacting with said chlorite solution under the influence of heat and selected from the group consisting of formic acid, hydrochloric acid and acetic acid, impinging separate jets of superheated steam at a temperature of above 105° C. and at a rate of speed not less than 5 meters per second on said product imbued with said solution and said activating agent during passage of said product through said treatment machine, so that said machine is filled with a dry superheated atmosphere and said solution within said product is brought to its boiling point, thus effectuating evaporation of said solution and transforming the evaporated solution into a dry gaseous fluid containing chlorine dioxide gas outside said product for bringing about bleaching action on the product within said machine, whereby moisture therein is eliminated thereby to simultaneously inhibit corrosion of said machine parts.

2. The process of bleaching a fibrous product in a treatment machine in which ferrous metal parts thereof are exposed to corrosion by dioxide of chlorine evolved under the influence of heat from an impregnating liquid in the form of a solution of chlorite, with which the fibrous product has been imbued; said process comprising the steps of applying to said product an activating agent capable of reacting with said chlorite solution under the influence of heat so as to give off dioxide of

chlorine, impinging separate jets of superheated steam at a temperature of about 105° C. and at a rate of speed not less than 5 meters per second on said product imbued with said solution and said activating agent during passage of said product through said treatment machine, and conditioning said jets so that said solution within said product is brought to its boiling point, thus effectuating at least partial evaporation of said solution and transforming the evaporated solution into a dry gaseous fluid containing chlorine dioxide gas outside said product, to complete the bleaching of the product within said machine and to eliminate any moisture therein thereby to simultaneously inhibit corrosion of said machine parts by said gas.

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