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STEREOTYPE MAT

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This invention relates to stereotype mats and particularly to the treatment of the face of the mat which receives the impression to improve its qualities for producing a sharp, clear-cut impression of the printer's form, and for permitting the casting of a large number of perfect plates therefrom.

The stereotype mat in common use, and the one with which this invention is concerned, is composed substantially of cellulose fibers. Such a mat is described in my United States Patent 1,524,155, granted January 27, 1925. If the surface of such a mat is not made perfectly smooth, loose fibers project therefrom. In addition, when the mat is pressed upon the form, slight fractures may be produced in the mat and some of the fibers may be loosened partially and project above the surface of the mat. The projecting fibers become embedded in the cast when the molten stereotype metal is poured upon the mat and when the cast is withdrawn the mat surface is torn or peeled. If peeling occurs on the impressed areas of the mat, it is no longer possible to obtain perfect casts from the mat.

Surface treatments have been used heretofore to improve the smoothness, plasticity and casting qualities of stereotype mats. Some of these treatments provide for mechanical smoothing. Others provide for the application of finely divided filling materials, which are more or less plastic and unctuous, to the surface of the mat. They are susceptible to formative treatment and promote the free release of the cast metal. An example of such a surface application is described in my United States Patent No. 1,863,731, granted June 21, 1932.

It has also been the practice, to a limited extent, for stereotypers to give the surface of the mat a wash with a dilute solution of aluminum sulphate just prior to the casting operation. The aluminum sulphate hydrolyzes the fibers of the mat and renders them friable. This has been found to produce an improvement in the casting qualities of the mat because any fibers which may be embedded in the metal break without injury to the surface.

The present invention relates to an improvement in the latter character of treatment. Anything which requires extra time on the part of the stereotyper during the rush of casting plates for newspaper printing is decidedly objectionable. Ordinarily aluminum sulphate may not be applied in advance of this time unless the interval between its application and the use of the mat is carefully controlled, because the material diffuses gradually throughout the body of the mat, and upon the application of heat, it causes friability of a large proportion of the fibers throughout the entire mat. The resulting weakness and brittleness of the mat frequently reaches a point where the mat can not withstand the handling which it must necessarily receive and the mechcanical action of removing the cast that is made from it. Frequently the same mat is taken to several different casting rooms and subjected to casting operations in each or is used for more than one edition. It is, therefore, necessary that the mat retain a considerable proportion of its natural strength and flexibility in order that it may stand handling and may be removed intact from the cast metal after each casting operation.

It is the object of the present invention to provide a new and improved treatment for modifying the texture of a stereotype mat to improve its qualities for receiving an exact impression of the form and imparting the same exact impression to a large number of metal casts.

It is also an object of the invention to provide a treatment of the character described which does not materially impair the strength and flexibility of the mat, even though long periods elapse between the treatment and the use of the mat.

It is also an object of the invention to provide such a treatment which may be applied during the process of making the mat.

The treatment provided by this invention comprises the application to the surface of the stereotype mat of a cellulose-carbonizing substance, or agent, under such conditions that the carbonizing action is mild and is restricted substantially to the impression-receiving portion of the mat. The remainder of the mat retains its resilient fibrous character. The preferred method of restricting the action is by using a carbonizing agent which is substantially insoluble or difficultly soluble in cold water, but is appreciably soluble at higher temperatures. A water suspension of the substance is applied to the mat. The solids are held on the surface of the mat and within the layers of fibers adjacent the surface, and at ordinary atmospheric temperatures remain in a substantially inactive state for an indefinite period. The mat is maintained in a humidified condition until it is used or it is humidified before it is used. Upon scorching, the temperature of the moisture in the mat is raised and a portion or all of the substance goes into solution therein. In this condition, and at the temperature of scorching, it becomes reactive toward the cellulose fibers and a part of the carbonizing action takes place.

Substantially the same action takes place each time a cast of metal is made upon the mat. However, the scorching operation causes a large proportion of the moisture to be driven off rapidly in the form of steam, and each successive casting operation does the same until the mat becomes substantially dry. Carbonizing action gradually diminishes and it substantially ceases after the moisture has left the mat.

The carbonizing action may be obtained by means of compounds having an acid reaction whereby the cellulose is hydrolyzed to produce brittle hydrocellulose, or by means of oxidizing agents whereby the cellulose is converted to oxycellulose, which is likewise friable.

The carbonizing substance need not be completely insoluble in cold water, but for suitable performance, the cold water solubility should not exceed 5 percent at 30° C. On the other hand, the substance need not be completely soluble in hot water. Usually, the quantity of carbonizing substance required is sufficiently small in proportion to the amount of moisture present in the mat, that most of it goes into solution, if it is soluble to an appreciable extent. Sulphanilic acid and picric acid, which are stated hereinafter to be suitable carbonizing substances, are about 6½ percent soluble at 100° C. Potassium perchlorate is about 20 percent soluble at this temperature. Substances of such solubilities are intended to be included among those classed herein as being appreciably soluble in hot water. The hot water solubility may be, however, a great deal higher.

While the carbonizing agent may be applied to the surface of the mat and may remain there almost entirely until the mat is ready for use, it is desirable that the carbonizing action be not limited to the immediate surface. In some cases, during molding the fibers in the surface layers are cut rather than folded so that peeling is facilitated; hence it is desirable that the carbonizing action proceed from the surface of the mat to a depth equal to about one-fourth to one-third of the thickness of the mat. With proper regulation of the quantity and kind of carbonizing agent, the proper depth of the carbonizing action can be obtained.

The modified cellulose is sufficiently hard and compact to resist excessive wearing away and disintegration by the mechanical action of the metal both before and after it solidifies, and the mat retains its sharp and clear-cut impression throughout a large number of casts. At the same time, for about three-fourths of the thickness of the mat, its resilient fibrous character is preserved with the result that it retains its strength to a large extent.

Cold water soluble carbonizing agents may be used in conjunction with agents difficultly soluble in cold water to supplement the action of the latter substances. By cold water soluble substance is meant one which is appreciably soluble in cold water, that is, sufficiently soluble to go substantially completely into solution at the concentration used.

Alcohol soluble carbonizing agents may also be used and this invention contemplates their use in alcoholic solution.

The carbonizing substances may be organic or inorganic. A large proportion of them contain an acid radical which is the reacting component. The following is a list of suitable organic, cold water insoluble, or difficultly soluble, substances. They may be used separately or a mixture of two or more may be used. The materials are as follows: sulphanilic acid (amidobenzene-p-sulphonic acid), orthochlorbenzoic acid, picric acid, potassium picrate, picryl chloride, picramic acid, aminotoluene sulphonic acid (1,8), chlorotoluene sulphonic acid, naphthylamine sulphonic acids, aminonaphthol sulphonic acid (1,2,4,), aminonaphthol disulphonic acid (1,8,3:6) m-nitrobenzene sulphonic acid, p-toluene sulphonic acid, a mixture of 1,6- and 1,7-naphthylamine sulphonic acids (Cleve's acid), naphthol sulphonic acid (1,4) (Nevile and Winther's acid), nitro naphthalene sulphonic acid (1,5) (Laurents' acid), alpha and beta naphthylamine hydrochloride, phenylacetic acid, dinitrophenol and others.

A number of inorganic substances difficultly soluble in cold water are as follows: calcium monophosphate, potassium perchlorate and potassium persulphate.

As mentioned heretofore, a mixture of a carbonizing substance having low cold water solubility with one having high cold water solubility may be used. In some situations, such a mixture has advantages. The scorching and casting temperatures employed at some printing plants may vary as much as 100° F. from those employed at others and at those plants that employ the lower temperatures a carbonizing substance which is difficultly soluble in cold water may not react quickly enough to form friable cellulose throughout the face of the mat. A small proportion of the fibers may remain uncarbonized and this may be sufficient to cause peeling of the surface fibers during the first few casts. If this occurs the usefulness of the mat for further casts is impaired or destroyed. Cold water soluble substances react relatively vigorously and the admixture of relatively small amounts of such substances produces quickly, during scorching and the first casting operation, the carbonization of this small proportion of fibers. The amount of cold water soluble carbonizing substance should be substantially less than that which will produce sufficient friability to impair the strength and flexibility of the mat for casting purposes. Examples of suitable cold water soluble substances are zinc sulphate, ferrous and ferric sulphates and aluminum sulphate, both the normal and the basic compound.

Cold water insoluble substances may be applied by spraying or brushing a suspension thereof upon the mat surface. If spraying is to be used, the material should be sufficiently fine that it will not clog the spray nozzles. It should also be sufficiently fine that a uniform and relatively stable suspension may be made. A suitable vehicle, preferably an adhesive colloid such as gum arabic, boiled starch, dextrine, etc. may be used to make the suspension more stable. Such a vehicle also serves as an adhesive to bind the carbonizing substance to the surface of the mat. The suspension may be heated to effect solution of a proportion of the substance. Upon application to the mat, cooling takes place immediately and the carbonizing agent crystallizes on the surface. Little or no carbonizing action occurs at this time. The substance may also be incorporated in the face portion of the mat on the paper machine by spraying it upon the webs which go to make up the surface and subsurface portions of the mat as the sheet is being formed. The carbonizing agent may also be mixed with the pulp prior to the formation of the sheet or the layers thereof in which it is desired to incorporate the substance. The cold water soluble substances may be applied

by spraying or brushing a solution of suitable concentration upon the mat.

The reactive vigor of the different substances varies. In general, the organic substances exert a relatively milder action than do the inorganic substances. The quantity which is applied per unit of mat area determines the carbonizing effect which will be produced. Usually the quantity should be increased with increase of mat thickness. This is a matter best determined by experience. The same is true of the concentrations of the suspensions or solutions used. A few examples of the latter will be given.

Sulphanilic acid, which is the preferred of the organic substances, exerts the most satisfactory action when reduced to 300 mesh or finer and the concentration of the suspension is about 10 percent. To meet different conditions, the concentration may be varied from about 5% to about 15%. About 3 percent of boiled corn starch may be added to stabilize the suspension and cause the carbonizing agent to adhere to the face of the mat. A mixture of 7 percent sulphanilic acid and 7 percent orthochlorbenzoic acid has been found to produce very satisfactory results. A mixture of 5 percent sulphanilic acid and 5 percent aminonaphthol sulphonic acid (1,2,4) also produces excellent results.

As an example of an inorganic cold water insoluble substance, a 5 percent suspension of calcium monophosphate produces very satisfactory results.

Examples of the combination of cold water soluble and insoluble substances for producing the advantages of such a combination as discussed heretofore, are as follows: a mixture of 5 percent sulphanilic acid and 5 percent anhydrous aluminum sulphate; a mixture of 4 percent sulphanilic acid, 6 percent orthochlorbenzoic acid and 5 percent aluminum sulphate. Another satisfactory treatment comprises applying successively to the mat a 5 percent solution of aluminum sulphate and a 5 percent suspension of sulphanilic acid. The quantity of aluminum sulphate should not exceed about 0.4 gram per square foot of mat surface. More than this quantity results in impairment of the strength and flexibility of the mat, as explained heretofore. From about 0.2 to about 0.4 gram per square foot has been found to produce good results.

Examples of alcoholic solutions of carbonizing substances which produce satisfactory results are as follows: a 2 percent alcoholic solution of beta-naphthylamine hydrochloride; a 4 percent alcoholic solution of picric acid; and a 10 percent alcoholic solution of picryl chloride

It may be desirable to apply a release-promoting agent in addition to the fiber carbonizing agent. For best performance this is recommended as a general procedure. In some instances, if a release-promoting agent is not used, there is a tendency for the mat to adhere to the metal after the casting operation. The release-promoting composition described in my Patent 1,863,731 may be used. The release-promoting composition may be applied before or after the carbonizing agent although, in general, somewhat improved results are obtained if it is applied after the carbonizing agent. Good results have been obtained by incorporating a small amount, about 1 percent, of powdered aluminum stearate in the sulphanilic acid emulsion. Sulphonated higher alcohols, e. g., cetyl sulphate, $C_{16}H_{33}OSO_3H$, have been found to promote release very effectively and at the same time act as carbonizing agents. A small quantity, about 1 to 3 percent, may be incorporated in the emulsion or solution of carbonizing agent.

The examples of procedure and concentrations of treatments are given only as illustrations of what has been found to be suitable for the purpose. Uniformity of distribution may be improved if several applications of less concentrated solutions are given, the mat being permitted to dry somewhat between applications if that is necessary.

I claim:

1. The method of improving the casting properties of a stereotype mat without impairing the strength and flexibility thereof which comprises coating said mat with a cellulose carbonizing substance which is not more than 5% soluble in water at 30° C. and appreciably soluble in hot water, and heating said stereotype mat to a temperature at which the moisture therein is expelled rapidly from said mat.

2. The method of improving the casting properties of a stereotype mat which comprises coating said mat with a cellulose carbonizing substance which is not more than 5 percent soluble in water at 30° C. and is appreciably soluble in hot water, and heating said stereotype mat.

3. The method of improving the casting properties of a stereotype mat which comprises coating said mat with a cellulose carbonizing substance from the group consisting of orthochlorbenzoic acid, picric acid, potassium picrate, picryl chloride, picramic acid, phenyl-acetic acid, dinitrophenol, calcium mono-phosphate, potassium perchlorate, potassium persulphate and the organic sulphonic acids which are not more than 5% soluble in water at 30° C. and appreciably soluble in hot water, and heating said mat while it is in humidified condition.

4. The method of improving the casting properties of a stereotype mat which comprises coating said mat with a finely divided organic sulphonic acid which is not more than 5% soluble in water at 30° C. and appreciably soluble in hot water, and heating said mat while it is in humidified condition.

5. The method of improving the casting properties of a stereotype mat which comprises coating said mat with a finely divided substance having an acid radical capable of mildly carbonizing cellulose, said substance being not more than 5% soluble in water at 30° C. and appreciably soluble in hot water, and heating said mat while said mat is in humidified condition.

6. The step in the method of improving the casting properties of a stereotype mat which comprises coating said mat with an aqueous suspension containing sulphanilic acid.

7. The method of improving the casting properties of a stereotype mat which comprises coating said mat with a suspension containing a mixture of substanaces capable of carbonizing cellulose, one of said substances being not more than 5% soluble in water at 30° C. and appreciably soluble in hot water and another of said substances being soluble in cold water, and heating said mat while it is in humidified condition.

8. The method of improving the casting properties of a stereotype mat which comprises coating said mat with a suspension containing sulphanilic acid and aluminum sulphate, and heating said mat while it is in humidified condition.

9. The method of improving the casting properties of a stereotype mat which comprises coating said mat with an alcoholic solution of a cellulose carbonizing substance which is not more

than 5% soluble in water at 30° C. and appreciably soluble in hot water, and heating said mat while the mat is in humidified condition.

10. A stereotype mat having a coating comprising a substance capable of carbonizing cellulose fibers, said substance being not more than 5% soluble in water at 30° C. and appreciably soluble in hot water.

11. A fibrous stereotype mat having incorporated among the fibers adjacent the casting surface thereof a finely divided substance having a reactive acid radical capable of carbonizing said fibers, said substance being not more than 5% soluble in water at 30° C. and appreciably soluble in hot water.

12. A fibrous stereotype mat having incorporated among the fibers adjacent the casting surface thereof a finely divided substance from the group consisting of the organic sulphonic acids which are not more than 5% soluble in water at 30° C. and appreciably soluble in hot water, orthochlorbenzoic acid, picric acid, potassium picrate, picryl chloride, picramic acid, phenylacetic acid, dinitrophenol, calcium mono phosphate and the perchlorate and persulphate of potassium.

13. A fibrous stereotype mat having incorporated among the fibers adjacent the casting surface thereof finely divided particles of a sulphonic acid which is not more than 5% soluble in water at 30° C. and appreciably soluble in hot water.

14. A fibrous stereotype mat having incorporated among the fibers adjacent the casting surface thereof finely divided particles of sulphanilic acid.

15. A fibrous stereotype mat having a coating comprising a cellulose carbonizing substance not more than 5% soluble in water at 30° C. and appreciably soluble in hot water and a water insoluble salt of a higher fatty acid.

16. A fibrous stereotype mat having a coating comprising a mixture of a cellulose carbonizing substance not more than 5% soluble in water at 30° C. and appreciably soluble in hot water, and a cold water soluble cellulose carbonizing substance, and a water insoluble salt of a higher fatty acid.

17. A fibrous stereotype mat having a coating comprising sulphanilic acid, aluminum sulphate, and a water insoluble salt of a higher fatty acid.

18. A composition for treating the casting surfaces of stereotype mats comprising a water suspension containing an adhesive colloid, and a finely divided cellulose carbonizing substance which is not more than 5% soluble in water at 30° C. and appreciably soluble in hot water.

19. A composition for treating the casting surfaces of stereotype mats comprising a dilute aqueous suspension containing sulphanilic acid and a sulphonated higher alcohol.

20. The step in the method of improving the casting properties of a stereotype mat which comprises coating said mat with a cellulose carbonizing substance which is not more than 5% soluble in water at 30° C. and appreciably soluble in hot water.

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