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2,825,645

STEREOTYPE MAT

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This invention relates to improvements in stereotype dry mats whereby the molding and casting properties thereof are improved. The invention also relates to the method whereby such improvement is effected.

There are two kinds of stereotype mats known to the industry, the dry mat and the wet mat. The wet mat is composed of a number of sheets of absorbent paper joined together with a paste, the mat having a facing of tissue which is also joined to the body by means of paste. It is prepared in the moist condition in the shop where it is to be used, and it is used in the freshly made condition.

The present invention is not concerned with the wet mat, but rather relates to the dry mat. In accordance with conventional practice, a stereotype dry mat comprises a relatively thick sheet of felted cellulose fibers and a filler. The fibers may be composed of rag stock, cotton linters, wood fibers such as alpha, sulfite, soda pulp fibers, or the like. An aqueous slurry of the fibers, mixed with the filler, which is usually powdered clay, talc, etc., is prepared in the wet machine of a paper-making machine, and the mixture of fibers and filler is felted upon the screen of the wet machine to form a web, which is transferred from the screen to a moving endless felt and thence to a revolving roll upon which the web is wound until a sufficient number of layers has been built up to form a mat of the desired thickness. The mat is removed from the roll and dried and compressed until it is of suitable thickness, usually .015 to .040 inch, for a stereotype mat. During the drying operation, the face of the mat is calendered, whereby it is made smooth and there are no projecting fibers, while the back is usually maintained against a porous surface such as a woven fabric belt, whereby the moisture escapes readily. As a result of this, the back is porous and irregular, relative to the face. The face of the mat is the surface which receives the impression from the form or pattern and against which the molten metal is cast to form the stereotype plate.

To promote the release of the plate after the casting operation, a coating composition may be applied to the face of the stereotype mat consisting of an aqueous suspension of suitable ingredients, such as a salt of a higher fatty acid, clay, and starch, dextrin or the like. A suitable composition for this purpose is disclosed in United States Patent No. 1,863,731.

The stereotype mat is made ready for use by moistening it with water to render it plastic, the usual water content being 7% to 50%, based on the weight of the moistened mat. In this moistened condition, the form containing the type, cuts, half-tones, etc. is impressed against the face of the mat and the latter takes a deep and well-defined impression of the form, including the details thereof. It is essential that the mat readily absorb moisture for this purpose and in the moistened condition is highly plastic.

After the impression has been taken, the moisture is driven out of the mat by subjecting it to heat in what

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is called a "scorcher." An essential property of the mat is that it permits the rapid and complete escape of moisture without undergoing rupture. After the mat is dry, it is ready for the casting operation, and for this purpose it is usually placed in a casting box. Most printing is done on cylindrical presses, and in such case the casting box is of curved shape and the mat is curved to conform to this shape. The molten type metal is cast against the face of the mat in the casting box, and the metal is allowed to cool and solidify, after which the cast plate is separated from the mat.

For satisfactory performance, a stereotype mat must be able to undergo a large number of such casts, thirty and more being not uncommon. It is, therefore, of extreme importance that after molding, the face of the mat be smooth and tough and free of any roughness and projecting fibers. Otherwise, the molten metal will adhere at the rough areas and flow around the projecting fibers, and when the solidified metal is separated from the mat it will tear away the surface material at the rough areas and pull out the projecting fibers, with the result that the face of the mat is impaired and the usefulness of the mat for taking further casts is destroyed.

The following properties are essential in a stereotype dry mat. It must be moisture-absorbent and must be soft and plastic when moist and have a very smooth face, whereby in the molding operation it takes a deep impression with a minimum of pressure and faithfully reproduces the original form, and in the casting operation it produces a smooth, accurate printing plate. During the scorching operation, it must quickly and without rupture release the moisture and shrink uniformly and the desired amount. It must be flexible when dry so that it will conform to the curve of the casting box, and it must still have the strength to retain the impression and withstand the weight of the cast metal whereby the latter does not compress the mat and cause a loss of depth of the characters of the cast plate. It must be strong and tough and resistant to heat so as to withstand the molding and casting operations. In this connection, it must withstand even the slightest decomposition which would otherwise cause imperfections in the cast stereotype plate.

It is the principal object of the present invention to provide a stereotype dry mat having superior plasticity when moist whereby the desired deep, clear-cut, detailed, faithful impression is received from the form with a minimum of pressure.

It is the further object of the invention to provide a stereotype dry mat having the above described improved properties and which retains the full amount of strength for mats of this character and undergoes the normal amount of shrinkage when dried.

It is a further object of the invention to provide a stereotype dry mat having the improved properties described above and which permits the ready release of moisture during drying and in the dry condition is sufficiently flexible to conform easily to the curve of the casting box and possesses the other properties which are stated above to be essential in a stereotype dry mat.

Other objects and advantages will become apparent as the following description progresses.

Briefly, the objects are accomplished by incorporating as a filler in the mat, in partial or complete substitution for the fillers normally used, a hydrous oxide from the group consisting of the hydrous oxides of silicon, aluminum and chromium. It is not necessary that the hydrous oxide replace the ordinary filler entirely, and an amount of such filler may be used along with the hydrous oxide, but best results are obtained when the ordinary filler is absent.

For the purpose of the present invention, natural

hydrous oxides are not suitable, and the invention contemplates those hydrous oxides of silicon, aluminum and chromium which have been formed synthetically by precipitation from aqueous solutions. Methods for the preparation of hydrous oxides of silicon, aluminum and chromium by precipitation from aqueous solution are well known to persons skilled in the art and any such method may be used in preparing the hydrous oxides for incorporation in the stereotype dry mat, in accordance with the present invention. Several methods of preparation of the hydrous oxides will be described hereinafter, but it is to be understood that these are by way of example and not of limitation and that any suitable method may be used. In the ordinary procedure for producing the precipitated hydrous oxides, they are dried after being precipitated and before being incorporated into the mat. This is a satisfactory procedure for the purpose of the invention. However, in accordance with the invention it has been discovered that, in the cases of the hydrous oxides of silicon and aluminum, as an alternative procedure the moist, fresh, precipitated oxide may be subjected to freezing and thawing instead of being dried. The resulting mat exhibits the same improved moist-plasticity as does the mat containing the oxide which has been dried. In the same way, it has been discovered that the moist, fresh, precipitated hydrous oxide of aluminum may be subjected to a boiling operation instead of being dried, and that an oxide having the desired properties as a filler is produced by such procedure.

The reason why the superior moist-plasticity, and the superior molding and casting properties are obtained by the use of the synthetic hydrous oxides of silicon, aluminum and chromium is not fully understood, but is believed to be because these hydrous oxides have the peculiar property of producing increased bulk or decreased density of the body of the mat over that obtained when ordinary fillers such as clay, talc, etc. are used. Such increased bulk is obtained without any decrease in strength of the mat.

According to Weiser's book "The Hydrous Oxides" (McGraw-Hill 1926, page 30) the hydrous oxides, including the hydrous oxides of silicon, aluminum and chromium, do not form definite hydrates. Therefore, where they are designated herein by formula, the formula will include the term " xH_2O " to indicate the indefinite hydration.

In accordance with the present invention it has been discovered that a stereotype mat having superior moist-plasticity and superior molding and casting properties is obtained when a precipitated hydrous oxide from the group consisting of the hydrous oxides of silicon, aluminum and chromium is incorporated as a filler in the mat. It is preferred that the hydrous oxide be ground to powdered or comminuted condition, but this is not necessary for satisfactory results, because the precipitated hydrous oxides in question are sufficiently soft and frangible that small lumps thereof are readily broken down during the operation of mixing the oxides with the fibers which precedes the felting of the mixture into a sheet. The proportions of hydrous oxide may vary within relatively wide limits. If it is used in admixture with other fillers, as little as 1.0% produces substantial beneficial results in improved moist-plasticity. When used alone, an amount of from 5% to 35% produces satisfactory results. All proportions given herein, in the description and the claims, are on a weight basis and the proportions of oxide are given in terms of the amount of the oxide, exclusive of water of hydration, based on the combined dry weight of the oxide and the fibers. For example, the amount of the hydrous silicon dioxide is in terms of the weight of SiO_2 , based on the combined dry weight of SiO_2 and fibers.

The following are several examples of the preparation of a stereotype dry mat in accordance with the present

invention. It is understood that these examples are by way of illustration only and that variations may be made therefrom by persons skilled in the art.

Example 1

To 138 parts of a water solution of sodium silicate having the ratio $1Na_2O:3.3SiO_2$ and containing 10% of SiO_2 is added with constant stirring approximately 32 parts of a water solution of sulfuric acid containing 20% of H_2SO_4 . Hydrous silicon dioxide, $SiO_2 \cdot xH_2O$, containing approximately 13.8 parts of SiO_2 , is precipitated in this solution. The reaction mass is dried at $110^\circ C.$ and is then transferred to a ball mill and the hydrous oxide is ground to a powder in the presence of water.

The hydrous silicon dioxide is incorporated in a stereotype mat by a procedure the manipulative steps of which are similar to the conventional procedure. An aqueous slurry of alpha cellulose fibers is placed in a beater and beaten until the fibers are well separated and have undergone a suitable amount of hydration. An aqueous slurry of the hydrous silicon dioxide is then added and the mass is agitated in the beater until the oxide and the fibers are thoroughly mixed together. The proportions are caused to be 30 parts of fibers and 7 parts of SiO_2 . The slurry containing the mixture of fibers and hydrous oxide is transferred to a paper-making wet machine and the amounts of water and solids are adjusted to form a suspension of the desired concentration. The mixture of fibers and hydrous silicon dioxide is felted out in the form of a web on the screen of the wet machine and the web is transferred to a moving felt and thence to a roll upon which it is wound until a sufficient number of layers have accumulated to form a sheet of the desired thickness. The sheet is then removed from the roll and dried and compressed to the desired thickness and calendered upon its face to form the stereotype mat, and the latter has a coating applied to the face thereof as described hereinbefore. The resulting mat contains 14.5% of SiO_2 , based on the combined dry weight of the fibers and SiO_2 .

In the foregoing procedure, for convenience the entire mass from the ball mill, including the soluble products of reaction, are placed in the beater. These soluble constituents are substantially eliminated in the waste water of the wet machine.

In use, the stereotype mat is moistened with approximately 7% to 50% of water, 20% being quite satisfactory. The moistened mat containing hydrous silicon dioxide is plastic to a high degree and its face is very smooth, whereby it takes a deep and exact impression from the printing form with a minimum of pressure. The detail of the impression is clear-cut and sharp, even with respect to the half-tones. The moisture is readily and easily released during the scorching operation and the face of the molded mat is tough and smooth, while the mat at the same time is sufficiently flexible that it is easily shaped to fit the curved casting box. The mat is also resistant to the molten type metal and readily releases the cast printing plate, whereby a large number of casts can be made from the same mat. In addition, the plates are of high quality, and carry in exact and sharp definition the details of the original form. In these various respects the stereotype mat of the present invention is superior to one which contains an ordinary filler.

Example 2

A stereotype mat is made in the same manner as described in connection with Example 1 with the difference that after the hydrous silicon dioxide has been precipitated in the aqueous solution, the solution is frozen and thawed, and then mixed with water and ground in a ball mill. After the grinding operation, the hydrous silicon dioxide is mixed with previously beaten cellulose fibers and the mixture is formed into a stereotype mat by a procedure similar to that described in connection with

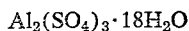
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Example 1. The resulting stereotype mat exhibits improved moist-plasticity similar to that of the mat of Example 1.

To obtain the improved moist-plasticity from the use of the frozen oxide, the freezing step should be carried out while the hydrous oxide is in the moist, fresh, precipitated condition, that is, in the condition after precipitation and before drying. If the oxide is dried and moistened again and then subjected to the freezing operation, the freezing step produces little or no effect. However, if the oxide is kept moist after precipitation, the freezing operation may be delayed for any desired length of time. Likewise, the reaction solution can be partially or completely replaced with water by washing the precipitate with water, and freezing of the resulting mass still produces a product having the desired beneficial properties. An alteration occurs upon drying of the precipitated hydrous oxide, and by the term "fresh" is meant herein in the specification and claims, the condition of the precipitate before drying. An oxide having the desired properties is produced by freezing and thawing the contained moisture in the moist, fresh, precipitated hydrous oxide.

Example 3

To 300 parts of an aqueous solution of



containing 5.05% of $\text{Al}_2(\text{SO}_4)_3$ is added with constant agitation 100 parts of an aqueous solution of sodium hydroxide containing 10.6% of NaOH. Hydrous aluminum oxide, $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ is precipitated in the solution, containing approximately 4.5 parts of Al_2O_3 . The reaction mass is dried at 110° C. and then ground to a powder in the presence of water in a ball mill. The resulting water slurry is added to previously beaten cellulose fibers and a stereotype mat is prepared containing the hydrous oxide of aluminum by a procedure similar to that described in connection with Example 1. The finished mat contains 11.3% of Al_2O_3 , based on the combined dry weight of fibers and Al_2O_3 .

Example 4

The procedure is the same as in Example 3 with the difference that the reaction mass, after precipitation of the hydrous aluminum oxide, is frozen and thawed and then ground with water in a ball mill, after which the mass is added to previously beaten cellulose fibers and the mixture of fibers and oxide is formed into a stereotype mat by a procedure similar to that described in connection with Example 1.

Example 5

The procedure is the same as in Example 3 with the difference that reaction mass, after precipitation of the hydrous aluminum oxide and containing sufficient liquid to cover the solid oxide, is boiled, cooled substantially to room temperature, ground and added to previously beaten cellulose fibers. The mixture of fibers and oxide is then formed into a stereotype mat.

Moist-plasticity is obtained from the use of the oxides produced by the freezing and boiling operations of Examples 4 and 5 similar to that obtained from the use of the dried oxide of Example 3. To obtain the desired effect from the freezing and boiling operations they should be performed upon the moist, fresh, precipitated hydrous oxide.

Example 6

A 5.31% aqueous solution of $\text{Cr}(\text{NO}_3)_3$ containing approximately 15.94 parts of $\text{Cr}(\text{NO}_3)_3$ is mixed with an 8.1% aqueous solution of sodium hydroxide containing approximately 8.1 parts of NaOH. Hydrous chromic oxide, $\text{Cr}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ containing approximately 5.09 parts of Cr_2O_3 , is precipitated in the solution. The reaction mass is dried at 110° C., ground with water in a ball mill and added to previously beaten cellulose fibers, and a

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stereotype mat is formed containing this hydrous oxide by a procedure similar to that described in Example 1. The finished mat contains 13.2% of Cr_2O_3 , based on the combined dry weight of fibers and Cr_2O_3 .

In the foregoing procedures, the soluble products formed during the precipitation of the hydrous oxide are added along with the oxide to the fibers in the wet machine. This is not objectionable because substantially all of such soluble products are disposed of in the waste water of the wet machine. This is a convenient procedure, but if desired the hydrous oxide can be separated from the reaction solution prior to addition of the oxide to the wet machine.

Synthetic precipitated hydrous oxides of silicon, aluminum and chromium are available upon the market and are suitable for use in accordance with the present invention. Stereotype mats containing such hydrous oxides exhibit the same superior properties as have those made in accordance with the foregoing examples.

As an indication of the superior plasticity exhibited by stereotype mats in accordance with the present invention, measurements have been made of the depth of penetration of the form during the molding operation on mats containing the synthetic precipitated hydrous oxides and a mat containing an ordinary filler.

Exactly the same molding procedure was employed in every case. The mats all contained the same proportions of fibers and filler, namely, 23 parts of filler and 100 parts of fiber, and they all contained the same moisture content, namely, 20%, based on the weight of the moistened mat. They were all molded by means of the same form, and the form was pressed against the mat with the same pressure, namely, 2,000 pounds per square inch. The depth of penetration was measured at the same point of each mat. The mats tested contained respectively, hydrous silicon dioxide, hydrous aluminum oxide, hydrous chromic oxide, and a conventional white clay filler which has been used extensively by the Burgess Cellulose Company in the manufacture of commercial stereotype mats. The hydrous silicon and aluminum oxides were obtained commercially upon the market and the hydrous chromic oxide was made in accordance with the foregoing Example 6. Except for the character of the filler, the mats subjected to the tests were identical. The height of the type of the original form or pattern at the point selected for measurement was .017 inch. The depth of the impression at this point in the respective mats was as follows, the mats being identified by the filler: hydrous aluminum oxide, .016 inch; hydrous silicon dioxide, .016 inch; hydrous chromic oxide, .015 inch; clay, .013 inch. At another point of the same form, the height of the type was .011 inch. The depth of the impressions at this point was as follows, again identifying the mat by the filler: hydrous aluminum oxide, .008 inch; hydrous silicon dioxide, .008 inch; hydrous chromic oxide, .008 inch; clay, .006 inch.

In each of the examples described hereinbefore, a single hydrous oxide is incorporated as a filler in the mat. It is to be understood, however, that mixtures of the several hydrous oxides, and mixtures of said hydrous oxides with other fillers may be used in the same stereotype mat if desired. Also, the mat may be composed of cellulose fibers other than the kind of fibers in the examples, and other changes may be made by those skilled in the art within the scope of the present invention.

What is claimed is:

1. A stereotype dry mat capable of undergoing the molding and casting operations of stereotyping procedure, and comprised uniformly throughout the thickness thereof of a co-felted mixture of cellulose fibers and discrete particles of a filler unattached to each other and unattached to said fibers, said filler being present in an amount sufficient to impart high plasticity to said mat when moist and containing as an essential constituent a substance selected from the group consisting of the syn-

thetic hydrous oxides of silicon, aluminum and chromium, and mixtures thereof, the amount of hydrous oxide, exclusive of water of hydration, being between about 1% to about 35% of the combined dry weight of the fibers and the oxide, said stereotype mat being characterized by high plasticity when moist.

2. A stereotype dry mat capable of undergoing the molding and casting operations of stereotyping procedure, and comprised uniformly throughout the thickness thereof of a co-felted mixture of cellulose fibers and discrete particles of a filler unattached to each other and unattached to said fibers, said filler being present in an amount sufficient to impart high plasticity to said mat when moist and containing as an essential constituent the synthetic hydrous oxide of silicon, the amount of hydrous oxide, exclusive of water of hydration, being between about 1% to about 35% of the combined dry weight of the fibers and the oxide, said stereotype mat being characterized by high plasticity when moist.

3. A stereotype dry mat capable of undergoing the mold and casting operations of stereotyping procedure, and comprised uniformly throughout the thickness thereof of a co-felted mixture of cellulose fibers and discrete particles of a filler unattached to each other and unattached to said fibers, said filler being present in an amount sufficient to impart high plasticity to said mat when moist and containing as an essential constituent the synthetic hydrous oxide of aluminum, the amount of hydrous oxide, exclusive of water of hydration, being between about 1% to about 35% of the combined dry weight of the fibers and the oxide, said stereotype mat being characterized by high plasticity when moist.

4. A stereotype mat capable of undergoing the molding and casting operations of stereotyping procedure, and comprised uniformly throughout the thickness thereof of a co-felted mixture of cellulose fibers and discrete particles of a filler unattached to each other and unattached to said fibers, said filler being present in an

amount sufficient to impart high plasticity to said mat when moist and containing as an essential constituent the synthetic hydrous oxide of chromium, the amount of hydrous oxide, exclusive of water of hydration, being between about 1% to about 35% of the combined dry weight of the fibers and the oxide, said stereotype mat being characterized by high plasticity when moist.

5. A stereotype dry mat capable of undergoing the molding and casting operations of stereotyping procedure, comprised uniformly throughout the thickness thereof of a co-felted mixture of cellulose fibers and discrete particles of a filler selected from the group consisting of the synthetic hydrous oxides of silicon, aluminum, chromium, and mixtures thereof, the amount of hydrous oxide, exclusive of water of hydration, being between about 5% to about 35% of the combined dry weight of the fibers and the oxide, said stereotype mat being characterized by high plasticity when moist.

6. A stereotype dry mat capable of undergoing the molding and casting operations of stereotyping procedure, comprised uniformly throughout the thickness thereof of a co-felted mixture of cellulose fibers and discrete particles of a synthetic hydrous oxide of silicon, the amount of hydrous oxide, exclusive of water of hydration, being between about 5% to about 35% of the combined dry weight of the fibers and the oxide, said stereotype mat being characterized by high plasticity when moist.

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