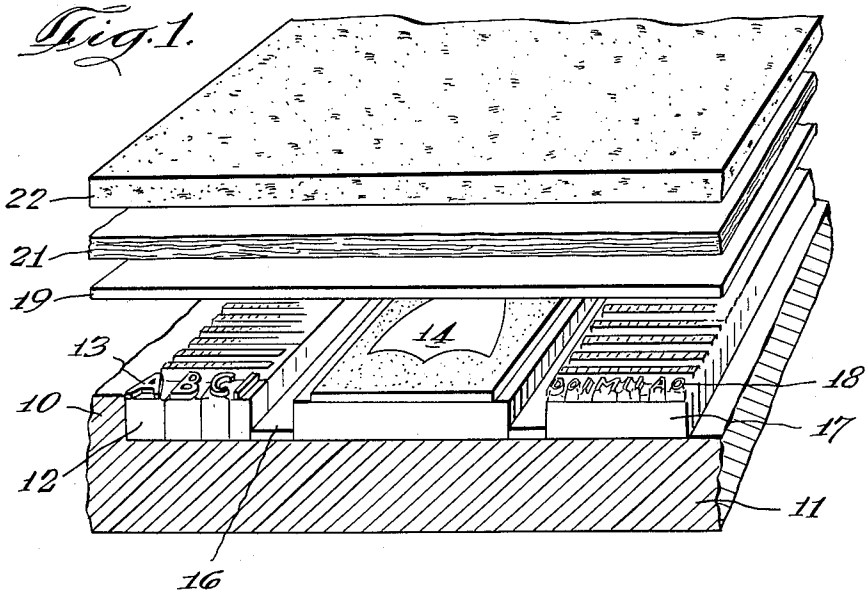
Sept. 26, 1961 P. B. HANSEN ET AL 3,001,899

STEREOTYPE MAT

Filed April 16, 1956 2 Sheets-Sheet 1

Fig. 1.



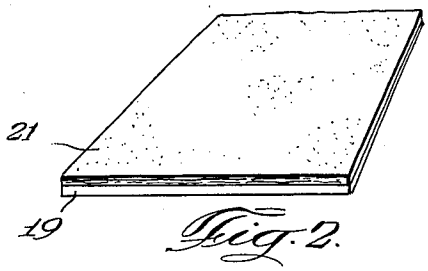


Fig. 2.

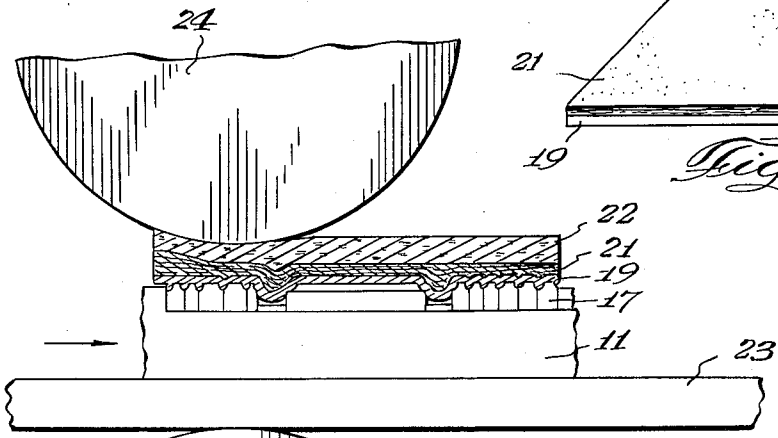
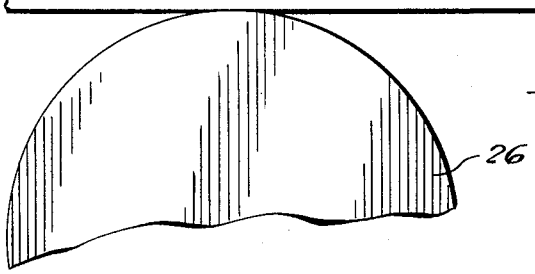


Fig. 3.



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STEREOTYPE MAT

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Fig. 4.

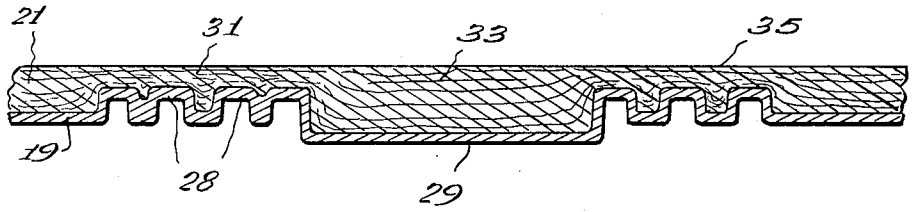
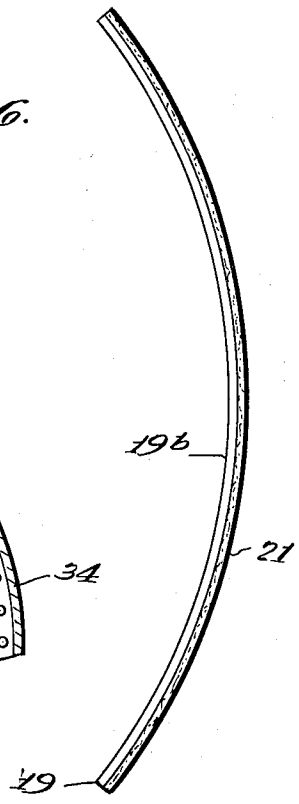


Fig. 6.



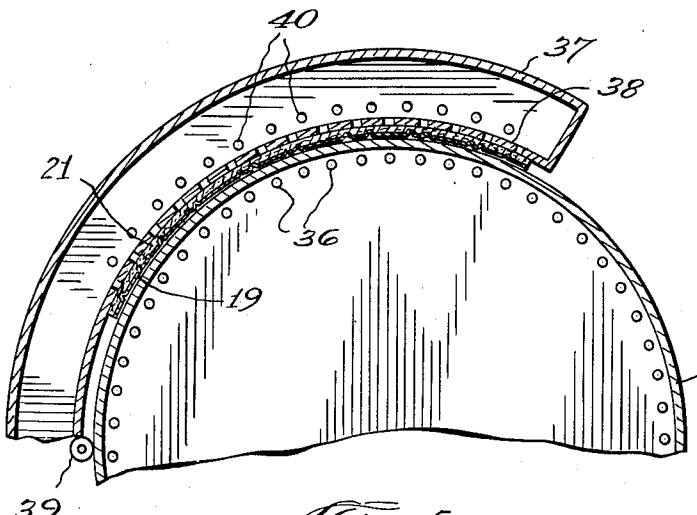


Fig. 5.

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3,001,899

STEREOTYPE MAT

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Filed Apr. 16, 1956, Ser. No. 578,293
5 Claims. (Cl. 154—46)

The present invention relates generally to stereotype mats and is particularly concerned with an improved composite stereotype mat and backing and with methods for manufacturing the improved backing.

In the usual process for making a stereotype plate for newspaper printing or the like, there is first made a stereotype matrix or mat from which the metal plates are cast. This stereotype mat, or "flong" as it is sometimes called, is usually made of a moisture-permeable paperboard material of suitable thickness to provide proper space-depth characteristics when imprinted with type and other printing elements. The steretotype mat is laid over a lockup containing the type, engravings and other printing elements and, generally, a molding combination of cork, felt or other suitable materials is laid over the stereotype mat. The lockup with the mat and molding combination in place is then subjected to sufficiently heavy pressure to press the mat into the face of the lockup and reproduce the printing elements in the stereotype mat.

Following the pressing operation, the mat is dried and formed, usually by a process which includes placing the imprinted mat in a curved former and dryer, sometimes termed the "scorcher." Generally, the dryer includes a curved, foraminous surface which is connected to a source of reduced pressure in order that the moisture liberated during the heating operation will be drawn off through the back of the mat.

Furthermore, it is the current practice in various printing industries to shrink stereotype mats quite substantially in order to reduce the size of the printed image and the amount of paper required in the printing operation. When this practice is followed, it is usually desirable to dry the mat in two steps, initially heating the flat mat to drive off some of the moisture and then placing the mat in the curved dryer mentioned above to complete the drying and forming of the mat. Since the actual stereotype plate is made by casting molten type metal against the curved paperboard mat as a matrix, it is necessary that the mat be completely dried prior to the casting operation and that it be sufficiently hard and rigid to resist the casting pressure.

Since the forming and casting operations involve quite substantial pressures, it has been found necessary to provide some means for preventing buckling or yielding of the mat in the nonprinting areas, and particularly those areas which are of substantial dimensions. In practice, the most common means for packing or backing the mat consists in attaching thin strips of paper felt, along the rear surface, in those areas of the mat which have rather large nonprinting areas. This packing is usually done after the mat has been molded and, if a pre-drying step is used, between the first drying and the final drying against the curved former. Reinforcement of nonprinting areas too small to be packed with felt strips is sometimes accomplished by running the point of a pencil on the back side of the mat in those areas to form nonplanar areas in the face of the mat which will resist buckling more effectively.

The hand packing of stereotype mats mentioned above is inherently time consuming and costly and, of even greater importance, it must be done at a time when every minute is vital, particularly in connection with

newspaper printing. Further, the packing of a mat in this manner requires the services of skilled workmen who must use considerable judgment in selecting the areas to be packed and in applying the packing material properly.

A recent development in the solution of the problem of hand packing stereotype mats has involved the use of a multi-ply, resin impregnated paper backing for the mat which is formed integrally with the mat and which eliminates the need for hand packing. The present invention relates to an improvement in the subject matter thereof.

It is the primary object of the present invention to provide an improved type of backing for a stereotype mat, which is completely moldable with the stereotype mat during the forming operation, and which can be set during the drying operation to provide a unitary structure with the stereotype mat having adequate strength and rigidity to resist the pressures produced during casting operation, and which is adapted to be held securely against the mat throughout the making of the composite mat and the subsequent uses thereof.

Other objects and advantages will be made apparent in the following description of the invention in connection with the accompanying drawings, wherein:

FIGURE 1 is a view in perspective of a portion of a lockup, illustrating one manner in which the mat, backing and molding composition are arranged in the practice of the invention.

FIGURE 2 is a view in perspective of a composite mat in accordance with the invention, with the backing attached.

FIGURE 3 is a fragmentary view in elevation of the assembly during pressing or molding of the mat about the printing form.

FIGURE 4 is an enlarged cross-sectional view of a portion of the backed mat after its removal from the molding press.

FIGURE 5 is a fragmentary view of the backed mat during its formation in the dryer.

FIGURE 6 is an end view of a dried and formed mat embodying this invention.

In the present invention, a paperboard mat or flong of the type now commonly used is provided with a paper backing preferably consisting of a plurality of plies of creped, cellulosic tissues having dispersed therein a resinous binder material including a thermally rigidifiable substance. A material of this type has been found to be properly moldable with the paperboard mat, particularly in that it is capable of becoming bonded to the mat and of taking a permanent set in the printing areas of the mat to provide the necessary rigidity and space depth characteristics in such areas, but still the backing retains its resiliency so as to provide the desired bulk in the portions overlying the nonprinting areas of the mat. Furthermore, when applied to a shrink-type flong, the shrinkage of the flong and backing which takes place during drying is very nearly the same as the unpacked mat or flong alone. It should be understood, however, that the invention is also adapted for use with stereotype mats that are not shrunk during their processing.

The preferred material for the backing consists of a plurality of plies of thin, creped cellulosic tissue having an air dry basis weight, before creping, within the range of from about 5 to 10 pounds per standard ream of 480 sheets, each 24 by 36 inches, having a crepe ratio generally in the range from 1.3 to 2.5, and containing a resinous substance of the type and amount disclosed hereinafter.

The proper selection of a resinous substance to be used in the backing is critical to the proper performance of the backing when applied to a stereotype mat or flong.

In order for such backing to be effective it must satisfy a number of conditions and the satisfaction of these prerequisites is primarily dependent on the action of the resinous impregnate used in the backing.

First of all, it is essential that the several plies of the backing be adequately bonded together during the drying of the multi-ply sheet after it is impregnated with the resinous substance, and preferably that sufficient "tack" remain in the backing to provide an effective bonding of the backing to the flong when the two are pressed together during the initial pressing or rolling of the two in the lockup, which is generally a cold molding operation. In this respect, it is intended herein that "tack" be defined as including the capability of becoming adhesive in the presence of moisture and the term is not confined to the description of an actual state of adhesiveness.

It is also necessary that the backing have adequate flexibility and moldability to satisfactorily perform its intended purpose and yet have sufficient stiffness, as supplied to the user, to facilitate handling in applying the backing to the flong. Then too, the binder used in the backing must be water soluble or dispersible in order to respond to the water in the sheet during initial formation of the multi-ply sheet to provide the proper bonding action between the several plies and, also, to respond to the moisture in the stereotype mat during the cold molding operation in the lockup to permit passage of the water from the stereotype mat through the backing material and to bond the two together during molding operation in the lockup. Consequently, it is essential that the resin treated backing be highly water sensitive and that it rapidly develop a high degree of adhesiveness or tackiness with a relatively small amount of moisture.

It is also very important that the thermosetting resin in the binder material for the backing be susceptible to relatively small advancement during the necessary drying step in initially forming the multi-ply backing, as well as during the ordinary shelf life of the finished backing which may be expected to be as much as six months or even longer. This necessary characteristic of the thermosetting resin is particularly important in providing for a wide range of advancement or cure during the actual use of the backing with a stereotype flong, especially in connection with the final scorching of the composite flong and backing. In this respect, however, it should be understood that the thermosetting resin should not be too green initially, that is, it should not be in too low a state of polymerization because it will then saturate the fibers of the tissue and produce a very soft and limp product, which will have insufficient bonding between the plies.

Furthermore, it is essential that the backing retain its molded shape after it is removed from the lockup, in order that it maintain the space-depth characteristics acquired during the cold molding operation throughout the final drying and curing of the composite mat and backing and thereby provide better plate reproduction.

Finally, the resinous binder for the backing material should be essentially thermosetting or irreversible in nature at temperatures within a range of practical operation for the final drying or "scorching" step, which temperatures are governed, at least in part, by a consideration of possible damage by heat to the fibers in the flong and backing.

It is seen from the foregoing that the requirements for the binder used in the backing sheet are quite critical and, consequently, it has been an extremely difficult task to provide a binder material which will satisfy all of the requirements and still be usable commercially. One of the more important advantages of the present invention is the provision of a binder material which reduces the criticality of the characteristics of the binder constituents and thereby greatly improves its commercial value, particularly with respect to a very substantial extension of the useful life of the backing.

The present invention provides an impregnating material for a sheet of low density, compressible material which meets all of the above described requirements and which combines with the sheet to provide a stereotype mat backing of improved characteristics. Generally, this invention provides for the addition to a sheet of the type described, preferably a plurality of plies of tissue, of a resinous material comprising a blend of a thermally irreversible resin and a hydrophilic organic material capable of becoming tacky or tenacious when exposed to moisture, with the resinous material being added to the sheet, as by impregnation, in substantial quantity. It is important, of course, that the components of the resinous material be mutually compatible, i.e. blend without precipitating or jelling.

The thermosetting or thermally irreversible resin may comprise from 65 to 95 percent of the impregnate while the hydrophilic material, such as a hydrophilic polymeric or copolymeric additive, may comprise from about 5 to 35 percent, such percentages being based on the dry solids weight. The resinous impregnate is added to the sheet in an amount of from about 15 to 75 percent, based on the dry weight of the combined materials in the impregnate and in the tissue sheet. It should be noted that the use of the hydrophilic polymeric or copolymeric additive in an amount much greater than the 35 percent stated above makes the impregnate too viscous to properly saturate the sheet in a satisfactory manner and, also, makes the impregnated sheet more sensitive to moisture than is desired in a satisfactory backing for a stereotype mat. The amount of hydrophilic additive used, within the stated range, will depend somewhat on the amount of solids in the impregnating material or saturant. A reduction of the solids content in the saturant will, of course, allow the use of a greater percentage of hydrophilic additive without making the impregnate too viscous or moisture sensitive. The usable amount of hydrophilic material will also be controlled to some extent by the method available for drying the impregnated sheet.

The irreversible resin in the impregnate, such as phenol-aldehyde or blends thereof, constitutes the major portion of the blend and is primarily intended to provide the necessary strength for the backing to resist the casting pressures incurred during the forming of a metal type plate from the stereotype matrix, although such resin also affords a certain amount of adhesion between the plies and between the backing and the mat. In order to provide the best space depth characteristics for the stereotype mat through utilization of a maximum degree of cure of the thermosetting resin in the scorcher, it is essential that the resin be initially provided in the finished backing with a suitable degree of cure, i.e. in an amount just sufficient to afford the proper rigidity to the backing sheet for handling and for withstanding the pressures of the cold molding of the stereotype mat and backing as a unit. And, as previously indicated, to provide a commercially acceptable backing having such characteristics, it is necessary that the thermosetting resin be prevented from becoming too far advanced in its degree of cure prior to its ultimate use by the stereotyper, which may be six months or even a year.

It has been found that the use of a thermosetting resin alone, such as a phenol-aldehyde, is not entirely satisfactory, particularly in that if the original backing is made sufficiently stiff the resin will cure too quickly beyond its useful life under ordinary room temperatures and, consequently, the backing will have to be used rather promptly if it is to be effective. Further, if the resin is not sufficiently cured, it does not have very good adhesive properties and thereby contributes to the failure of the plies to stay together and to the resulting inadequate bond between the backing and the mat. As a result, the range of usefulness of a thermosetting resin such as a phenol-aldehyde is quite restricted and the state of the resin at the time of impregnating the backing sheet is quite criti-

cal. It is not only difficult to properly control the characteristics of the resin at the time of impregnation, but it is also a considerable problem to preserve the impregnated sheet in a useable state wherein the sheet is malleable, that is, capable of bearing a load and retaining the form assumed under such load after it is removed. A sheet impregnated solely with a thermosetting resin is capable of retaining this required characteristic for a very limited time even under the most favorable conditions.

The difficulties mentioned above have been overcome by introducing other material into the resinous impregnate for the backing which, in effect, enhances the shelf life of the backing and greatly improves the bonding of the plies together as well as to the stereotype mat. It has been found that by adding to the thermosetting resin a hydrophilic polymer or copolymer, such as an alkali salt of a styrene-maleic anhydride copolymer, there is thereby achieved a very desirable control of the characteristics of the backing. The added substance not only prolongs the water sensitivity of the impregnated sheet, thereby prolonging its shelf life, but also broadens the range of usefulness of the impregnate in that it makes it effective at lower moisture contents without sacrificing the required strengthening or stiffening of the sheet. The hydrophilic additive also contributes to the ultimate strength of the composite mat and backing. One of the more important effects noted through the addition of a hydrophilic polymer or copolymer to the thermosetting resin is the reduction in the criticality of the rate of advancement of the thermosetting resin. The effectiveness of the impregnated sheet as a satisfactory backing for a stereotype mat is no longer so seriously affected by the advancement of the thermosetting resin either in the impregnating bath or that occurring during the period between the formation of the sheet and its use as a backing and, consequently, a much broader selection is offered in the character of the resin used and a much longer period of usefulness is realized for the finished backing. The use of a hydrophilic polymeric or copolymeric additive in the impregnate also affords the use of broader ranges in connection with the thermosetting resin content, the amount of moisture extraction, and the pH of the impregnate, while providing a satisfactory backing for a stereotype mat. Further, the hydrophilic additive serves as a very effective binder for the several plies of the backing and for bonding the backing to the stereotype mat.

The thermosetting resins which have been found suitable for use in the impregnate are the alkaline catalyzed one-step phenol-aldehyde type. The rate of the reaction or cure of these resins can be reduced by adjusting the pH downward to neutrality or slightly above. In this respect, with a pH of from 7.0 to about 7.3 there is a noticeable beneficial effect on the shelf life of the backing sheet, i.e. retention of tack and retardation of advancement of the resin.

Then too, it has been found that the addition of a partially hydrolyzed polyvinyl alcohol to the blend of phenol-aldehyde and hydrophilic polymeric or copolymeric additive, in relatively small amounts, is advantageous in many instances in that it aids in the uniform distribution of the resinous material throughout the backing sheet. The addition of the polyvinyl alcohol is primarily an expedient arising out of the particular process used in impregnating the backing sheet. Consequently, the polyvinyl alcohol can be readily eliminated where the uniform distribution of the impregnate throughout the sheet is not a problem.

The irreversible resin used is in a low state of polymerization, and is subject to a very slow rate of advancement at temperatures below about 20° C. In terms of the standard dilutability test for measuring molecular weight with respect to water-soluble resins, the irreversible resin used has a dilutability within the range of from about 2 to 1 to about 6 to 1 when a water-soluble resin is used.

The steretoype mat backing may be made of one or more sheets of suitable material, but preferably is in the form of a multi-ply tissue sheet comprising from about 3 to 20 plies of creped cellulosic tissue having an air dry basis weight, before creping, within the range of from about 5 to 10 pounds per standard ream of 480 sheets, each 24 by 36 inches, and having a crepe ratio generally in the range of from 1.3 to 2.5. The multi-ply tissue sheet is suitably impregnated with the resinous material, as by passage through a bath of the impregnate and then removing the excess liquid by passing the wet sheet through felt covered squeeze rolls. In this latter respect, it is desirable, of course, to use only such pressure as will not change the structural characteristics of the multi-ply sheet or its individual plies. The impregnated sheet is then dried by suitable means.

In a preferred form of the invention which has been successfully tested, a stereotype mat backing of the type described was made from 9 plies of creped cellulosic tissues made from chemical pulp, each individual sheet having an uncreped, drier basis weight of 5.9 pounds per standard ream of 480 sheets, 24 x 36 inches, and a crepe ratio before impregnation of approximately 2.3. Thus the basis weight of the creped material was approximately 13.5 pounds per standard ream.

The superposed sheets were impregnated by passage through a bath containing a resinous bonding agent comprising 90 percent of a one-step phenol-aldehyde resin, 7 percent of a sodium salt of styrene-maleic anhydride copolymer, such as Scriptite 50 sold by Monsanto Chemical Co., and 3 percent of a water soluble polyvinyl alcohol, such as Elvanol 51–05 sold by E. I. du Pont de Nemours & Co., the percentages expressed on the basis of dry solids content. The polyvinyl alcohol was added to prevent migration of the resinous impregnate during the drying of the backing sheet and thereby provide uniform distribution of the resin in the sheet. However, this problem arose primarily because of the particular drying method employed, and the need for a control element such as polyvinyl alcohol may be eliminated by using a different type of drier.

The dilutability of the phenol-aldehyde resin used in the test was approximately 4.5. In preparing the impregnate, it was first diluted in water to a solids content of about 32 to 34 percent and then sulfamic acid was added to adjust the pH to between 7.0 and 7.3. For a batch weight of 2000 pounds, about 6 pounds of acid is required to provide the stated pH. It has been found that by thus controlling the pH of the impregnating solution, a definite improvement is noted with respect to the ability of the thermosetting resin to retain its low state of polymerization over a longer period, between the formation of the backing and its use, and thereby affords longer storage of the backing without advancement of the resin.

Excess liquid was removed from the backing by passing it between squeeze rolls, to provide a total resin content of approximately 42 percent of the weight of the finished backing sheet on a volatile-free basis. The impregnated sheet was then dried by circulating hot air around the sheet at 300° F. for about 5 minutes.

The resin treated creped wadding sheets were used as a backing in connection with stereotype mats for a rotary press for printing newspapers. Generally, the advantages of the backing are realized by placing the backing on the side of the stereotype mat opposite that facing the type in the lockup and pressing the backing and mat against the type face in a cold molding operation. The backing thereby becomes securely bonded to the back of the mat.

A more detailed explanation of the use of the backing in connection with rotary press plate formation will be had with respect to the apparatus shown in the accompanying drawings. As seen in FIG. 1, there is included in the lockup or printing form **10** a heavy metal chase **11** for holding the printing elements in place. Substantially flush with the level of the case **11** is an arrangement of

printing elements including type slugs **12**, each of which contains raised type faces **13** and engraving **14** separated from the type **12** by means of a spacer **16**, and a second set of type **17** with its raised type faces **18**.

A stereotype mat **19** in the form of a permeable paperboard mat ordinarily containing from about 15 to 40 percent by weight of free moisture and having a thickness of from about .024 to .040 inch, is placed over the printing form **10**. The resin-impregnated backing **21** is then placed against the back of the mat **19** and a compressible cushion or molding combination **22**, which may comprise one or more sheets of yieldable material such as cork, or a mixture of cork and synthetic rubber and/or fabric, is placed over the backing sheet **21**. If desired an unimpregnated ply of tissue or the like may be used on one or both surfaces of the backing **21** to facilitate handling of the backing.

Mats of the type now generally used for newspaperwork shrink considerably upon drying for the reasons given above, depending in part upon their relative moisture content. This shrinkage occurs to the greatest degree transversely of the mat, i.e. at right angles to the machine direction of the fibers. The shrinkage in the lengthwise direction is ordinarily about half of what it is in the cross direction. In newspaper work it is common to use mats which provide from about one-half to about one and one-fourth inches in cross-wise shrinkage for a mat measuring about fifteen and nine-sixteenths inches wide and twenty-one and three-quarter inches long between the limits of the type area, where the drying is done in two steps, as will be described later. Where only one drying step is involved, it is desirable to allow for a slight decrease in shrinkage over that ordinarily anticipated, so that where a given mat may have a characteristic shrinkage of one and one-eighth inches it will shrink about one inch when combined with the backing material described.

The printing form **10** with the mat, backing and the molding combination in place is set on a table **23** and passed between the nip of a pair of pressure rolls **24** and **26**. One or both of the rolls **24** and **26** is made vertically adjustable to compensate for different thicknesses of printing forms. The pressures used in connection with the backed stereotype mat are substantially the same as those used presently in molding stereotype mats without any backing. It is difficult to measure the exact pressure employed, as the contacting areas of the roll to which the pressure is applied cannot be accurately ascertained. However, it is generally accepted that the molding pressures required for good reproduction are on the order of 2000 to 4000 pounds per square inch over the printing areas and may be considerably higher. It should also be understood that although the described method of molding stereotype mats is the most common method, the present invention is equally applicable to mat molding procedures involving the use of direct pressure with flat platens.

As pressure is applied to the assembly in the lockup, the mat **19** is compressed into the space between the raised printing characters and forms a sharply defined reproduction of the printing characters contained in the lockup or form **10**. The backing **21** is moisture permeable and, therefore, is capable of absorbing any moisture expressed from the stereotype mat **19**. The backing **21** is considerably more compressible than the mat **19** and, as a result of the pressing, the thickness of the backing **21** is considerably reduced over the printing areas. Under ordinary molding pressures, the thickness of the backing may be reduced by a factor of four or five times over the printing areas, so that a backing originally .050 inch in thickness may end up as a compressed backing of about .010 inch, whereas in the nonprinting areas the backing may be compressed to about .040 inch, thereby providing a space depth between the level of the nonprinting areas and the base of the printing areas of about .030 inch.

The described backing material is able to conform accurately to the contour of the back of the mat **19** during application of pressure. At the same time the backing **21** becomes quite securely bonded to the back of the mat **19** over the areas of the mat which are subjected to the high molding pressures. Although this bonding may be due in part to a mechanical locking of the relieved areas of the back of the mat within the complementary compressed areas of the backing, a major portion of the bonding is provided by the adhesive properties of the resinous material in the adjoining plies of the backing **21**, particularly the hydrophilic copolymer derivative, such as the sodium salt of styrene-maleic anhydride copolymer.

In the stated condition, however, the overall characteristics of the backing are such that it is able to withstand the molding pressure and does not collapse during the pressing operation. The phenolic resin in the backing is in a sufficient state of cure to provide adequate rigidity to sustain the loads imposed during the pressing operation. Furthermore, the styrene-maleic anhydride copolymer provides sufficient track to provide the necessary bonding of the backing **21** to the mat **19**.

A portion of the backed mat, after removal from the molding apparatus, is illustrated in enlarged form in FIGURE 4. As seen in that drawing, the face of the mat **19** is depressed in conformity to the shape of the lockup, as seen at **28** and **29**, depending upon the pressure, molding combination, and the space areas and depths available in the original lockup.

In the nonprinting areas, as for example in the area **29**, the remarkable resiliency of the backing **21** causes the backing to recover much of its original thickness after removal of the molding pressure, as indicated at **33**. Yet in the areas above the printing surfaces, such as the area **31**, the backing takes a more permanent set but still retains the high degree of flexibility and moisture permeability. The result is that the backed mat produced by the molding operation has a generally planar rear surface **35** which may be readily conformed to the surface of the dryer. Further, the backing material is packed into those small nonprinting areas that a hand packer does not even touch in the ordinary process of stereotype mat forming.

After the removal from the molding apparatus, the composite mat and backing is then ready for drying and for setting of the resinous impregnate. For the manufacture of curved plates, the mat **19** and its backing **21** are given a uniform curvature by introducing the mat into a conventional dryer assembly. One type of dryer or "scorcher," as it is usually called, is illustrated in FIG. 5 of the drawings and comprises an asbestos covered drum **34** in which a plurality of heating elements **36** are disposed beneath the asbestos surface. A cover or chamber **37** having a perforated inner face **38** and a plurality of heating elements **40** is hinged to the drum **34** at the hinge **39**. The backed mat is held against the inner face **38** by applying a vacuum to the back of the composite mat through the perforations in the face **38**. The cover is also heated by means of spaced heating elements contained therein.

The vacuum applied to the mat holds the mat in contact with the face **38** and spaces the face of the mat slightly from the asbestos covered surface of the drum **34** when the cover **37** is in its closed position. Thus, the vacuum serves not only to hold the mat in position, but also holds the back of the mat against a smooth surface so as to provide a uniformly curved reference surface for the mat. The temperature at the back of the dryer is ordinarily on the order of 250° to 400° F. As the heat is applied moisture is driven from the mat and passes through the porous backing material and is thereupon vented. In this respect, it is particularly important in a shrink type mat that the resinous impregnate should not become cured or rigid until substantially all of the desired shrinkage of the mat and backing, through removal

of the moisture, has taken place. Consequently, the thermosetting resins selected should be of a type that will become substantially cured throughout at a temperature somewhere near the upper range of the drying temperature which will prevail throughout the mat when essentially all of the moisture has been removed. Additional advantage is had with the described materials in that the styrene-maleic anhydride copolymer hardens under the temperatures of the scorcher.

Where only one drying step is used, with the described materials a treatment time of 3 to 6 minutes at temperatures of 250 to 400° F. will suffice to drive off the moisture and set the irreversible resins sufficiently under moisture conditions normally prevailing in the mat. The control of shrinkage is facilitated by operating at a lower vacuum, on the order of one and one-half inches of mercury during the first minute or two and then increasing it to a value of five to six inches of mercury when substantially all of the moisture has been driven off. When a pre-drying step is employed in conjunction with the final drying and forming, times of about 10 to 90 seconds at temperatures of about 150 to 300° F. may be employed during the pre-drying to initiate shrinkage of the composite mat without substantial change in the condition of the irreversible resin.

During the drying operation the thermosetting resin in the backing should be cured sufficiently so that it will resist collapse under the temperature and pressures encountered in the casting of the stereotype plate. It is believed that with impregnates of the described type a cure of at least 95 percent throughout the backing should be achieved. In other words, the thermosetting resin extractibles in the sheet should not exceed about 5 percent after scorching.

The extractibles content can be readily determined by the standard A.S.T.M. test (D494–41) which involves taking a known weight of a typical sample of the cured sheet material in finely comminuted form, and placing this sample in a Soxhlet apparatus where it is extracted with hot acetone for a period of four hours. The acetone is then evaporated under controlled conditions and the sample removed, so that the residue constitutes the extractible materials which have been dissolved by the acetone.

Upon removal of the backed mat from the dryer, the mat is ready for insertion in the casting box. The final form of the mat is illustrated in FIGURE 6 of the drawings and includes the paperboard mat **19** having a casting face **19***b* of concave shape and the backing **21** in which the resinous material has become set and rigidified by the heat treatment in the dryer. Composite mats of this type have been found to adequately resist collapse under type casting pressures on the order of 15 to 25 pounds per square inch.

In addition to the foregoing manner of forming and using a backing of the type described, it has been found that definite advantages are gained by employing further precautions. An improvement is noted in the effectiveness of the backing sheet if the backing sheet, just prior to its use, is at equilibrium in a relative humidity of 45 to 65 percent. Furthermore, it has been found advantageous to use the low range of heat in the scorcher, about 250–300° F., in order to achieve best results with the described backing.

The blend of resinous material described above affords definite improvement over previous backing sheets, particularly with respect to an improved attachment of the several plies to each other and to the stereotype mat, and in providing an improved resiliency in the backing to thereby achieve better plate reproduction with substantially better space-depth characteristics.

Although described with respect to particular materials, it should be understood that other suitable materials having the described characteristics might be employed without departing from the principles of this invention.

We claim:

1. A backing for a stereotype mat comprising a plurality of creped, cellulosic sheets impregnated with from about 15 to 75 percent, by weight on a dry basis, of a resinous material including from about 65 to 95 percent of a phenol-aldehyde resin and 5 to 35 percent of a styrene-maleic anhydride copolymer, said phenol-aldehyde resin being in a state of low polymerization and substantially completely water dispersible in such state, said phenol-aldehyde resin being substantially stable at temperatures below about 20° C. and being capable of becoming substantially cured at temperatures of between 250° and 400° F., whereby said backing is moisture permeable and said resinous material is subject to little change in physical characteristics below temperatures of about 20° C., and said resinous material becomes rigid at temperatures of about 350° F.

2. A backing for a stereotype mat comprising a plurality of creped, cellulosic sheets impregnated with about 15 to 75 percent by weight, on a dry basis, of a substance including a thermosetting resin which is in a low state of polymerization and substantially completely water dispersible in such state, said thermosetting resin comprising from about 65 to 95 percent of a phenol-aldehyde resin, by dry weight of the total solids content of said substance, from about 5 to 35 percent, by dry weight, of a styrene-maleic anhydride copolymer, and about 2 to 10 percent, by dry weight, of a water soluble polyvinyl alcohol, said substance being substantially stable at temperatures below about 20° C., and said substance being capable of becoming substantially cured at temperatures of between 250 and 400° F., whereby said backing is moisture permeable and said substance is subject to little change in physical characteristics below temperatures of about 20° C. but becomes substantially cured at temperatures of about 350° F.

3. A backing for a stereotype mat comprising from 3 to 20 plies of creped, cellulosic sheets impregnated with about 15 to 75 percent, by weight on a dry basis, of a substance including a one-step phenol-formaldehyde resin which is in a low state of polymerization and substantially completely water dispersible in such state, said cellulosic sheets having an uncreped basis weight of from 5 to 10 pounds per 480 sheets each 24 by 36 inches and a crepe ratio of from 1.3 to 2.5, said phenol-formaldehyde resin comprising from about 65 to 95 percent, by dry weight of the solids content of said substance, and from about 5 to 35 percent, by dry weight, of a sodium salt of styrene-maleic anhydride copolymer, said substance having a pH of from 7.0 to 7.3, said phenol-formaldehyde resin having a dilutability within the range of from 2.0 parts of water to 1.0 part of resin to about 6.0 parts of water to 1.0 part of resin and being substantially stable at temperatures below about 20° C., said substance being capable of becoming substantially cured at temperatures of between 250° and 400° F.

4. A composition which is particularly adaptable for use in impregnating a low density, compressible paper sheet to form a backing for a stereotype flong, said composition comprising a resinous substance including from about 65 to 95 percent, by dry weight of the solids content, of a phenol-aldehyde resin in a low state of polymerization and which is substantially completely water dispersible, from about 5 to 35 percent, by dry weight, of a sodium salt of styrene-maleic anhydride copolymer, and about 2 to 10 percent, by dry weight of a water soluble polyvinyl alcohol, said resinous substance being substantially stable at temperatures below about 20° C., and said resinous substance being adapted to be substantially cured at temperatures of between 250 and 400° F.

5. A composition which is particularly adaptable for use in impregnating multi-ply, crepe paper sheets in the

formation of a backing for a stereotype flong, said composition comprising a resinous substance including from about 65 to 95 percent, by dry weight of the solids content, of a thermosetting one-stage phenol-aldehyde resin in a low state of polymerization and which is substantially completely water dispersible in such state, from about 5 to 35 percent, by dry weight, of an alkali salt of styrene-maleic anhydride copolymer, water in an amount sufficient to produce a solids content of from 32 to 34 percent, and sulfamic acid in an amount sufficient to adjust the pH of the composition to a substantially neutral condition, said composition being substantially stable in its state of polymerization at temperatures below about 20° C., and said composition being capable of being substantially completely polymerized at temperatures between 250 and 400° F.

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