Dec. 5, 1967 R. H. GRAHAM ETAL 3,356,562

MATERIALS AND METHODS FOR THE PRODUCTION OF STEREOTYPE MATS

Filed June 22, 1964

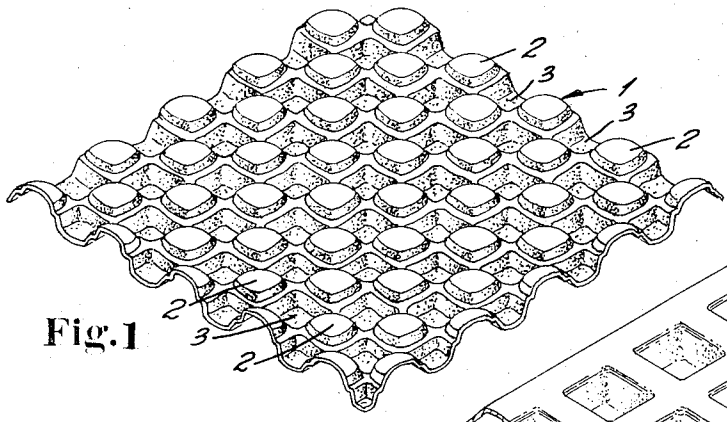

Fig. 1

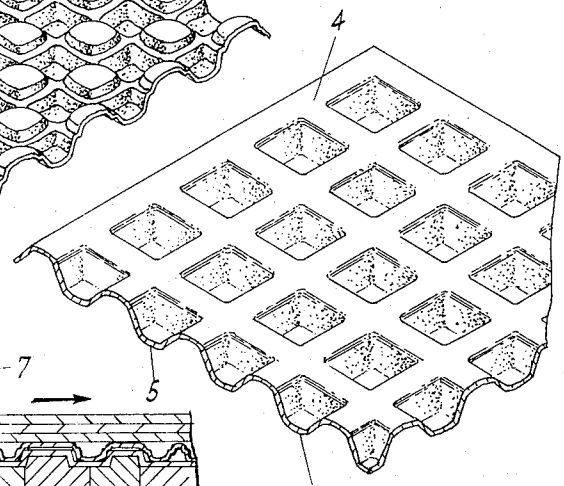

Fig. 1a

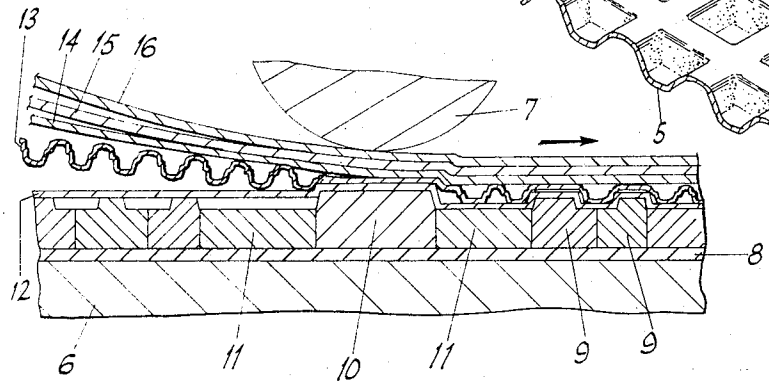

Fig. 2

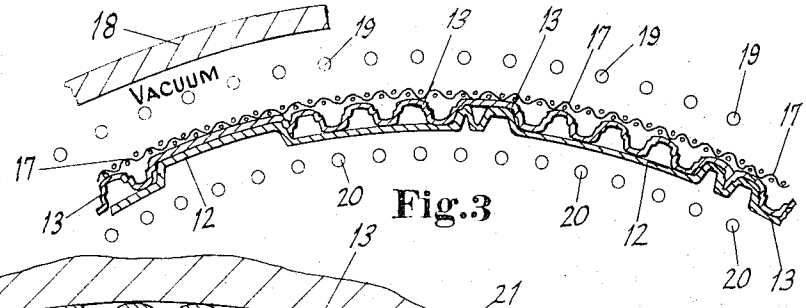

Fig. 3

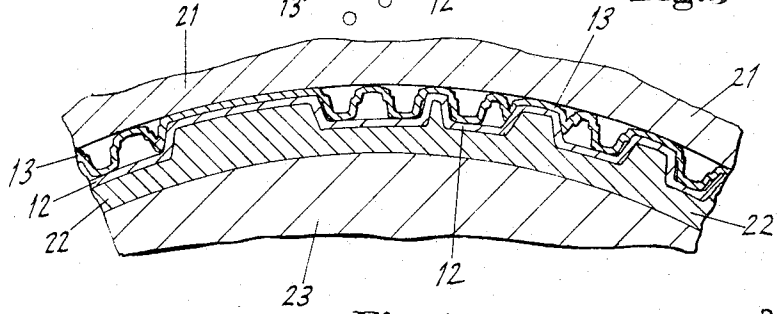

Fig. 4

INVENTOR.
RICHARD H. GRAHAM AND
VICTOR E. CALVIN,
Jungblut, Melville, Strasser & Foster
ATTORNEYS

United States Patent Office

3,356,562

Patented Dec. 5, 1967

3,356,562

MATERIALS AND METHODS FOR THE PRODUCTION OF STEREOTYPE MATS

Richard H. Graham and Victor E. Calvin, Cincinnati, Ohio, assignors to Cincinnati Industries Inc., Cincinnati, Ohio, a corporation of Ohio

Filed June 22, 1964, Ser. No. 370,630

9 Claims. (Cl. 161—128)

ABSTRACT OF THE DISCLOSURE

A backing sheet for packing a stereotype mat comprising a sheet of universally stretchable paper of essentially uniform thickness, such as crepe paper characterized by crossing sets of creping crinkles, the sheet having a multiplicity of gatherings which are sufficiently fine to avoid folding into multiple thickness when the sheet is applied to the back of a stereotype mat and compressed as the mat is molded, the sheet being indented to provide a series of uniform protuberances which are preferably smaller at their tops than at their bottoms, the sheet being coated on an indented surface with a uniformly distributed coating of a moisture sensitive adhesive, the sheet being characterized by resident gatherings which persist after indentation upon which the protuberances may collapse under molding pressure so that the collapsed areas of the backing sheet will return to the original uniform thickness of the sheet.

As is well known in the printing art, printing plates, such as those suitable for printing the pages of newspapers have heretofore been produced by the use of stereotype mats in the following way: printing means are assembled in a suitable form, these means being printing types, and other printing media, inclusive of rules, line etchings, half-tones, and the like. A porous cellulosic mat in a moist condition is laid over the assembly of printing media or characters in the form or chase and, by means of the platen of a suitable press (which platen is faced with a pressure pad), or in a roller press through which the form, the mat, and suitable pressure pad means are passed the mat is molded so that a reverse counterpart of the operating surfaces of the printing characters is impressed into a surface of the mat. The mat is then removed to a device wherein it is dried and shrunk in a curved condition, usually with the aid of heat and vacuum. The curved, dried and shrunk stereotype mat is then placed in a casting machine wherein, while the mat is supported in the curved condition, molten type metal can be cast between the concave surface of the mat and a core. The result will be (after the type metal casting has been dressed) the provision of a curved printing plate which may be used on the printing cylinders of high speed presses such as are used for the production of newspapers.

The cellulosic mat used in this procedure is capable of reproducing the very fine surface configurations of the printing characters in the chase, including such half tones as may be present. In the drying operation there is a shrinkage of the mat; but this shrinkage is desirable because it makes for a saving in newsprint. But it is generally necessary to "pack" the mat or flong before the type metal can be cast against it.

The various areas to be found in the embossed surface of a stereotype mat or flong range from flat or nearly flat depressed areas where half tones are being reproduced, through other areas in which typescript, logotypes or other relatively closely spaced printing surfaces are being reproduced, to areas (sometimes of very large size), where no printing at all is to occur. These last mentioned

areas on the embossed surface of the flong are raised so that there will be a depressed or non-printing area in the ultimate curved printing plate. But the stiffness of the dried flong is frequently not sufficient to withstand the weight and pressure of the type metal applied against it in the casting operation. The raised areas of the flong tend to become distorted under this weight and pressure so that, instead of a positive non-printing depression being formed in the cast plate, the type metal may rise in portions of the non-print areas to or nearly to the level of the printing characters, so that ink will be transferred to the paper by the printing plate in areas which should be perfectly clear. This action can be prevented by the use of "packing" to hold the non-print areas of the flong outwardly during casting; but since this operation consists in the pasting of appropriately cut pieces of paperboard, fiberboard or the like by hand to the reverse side of the non-print areas of the flong, the operation is tedious and costly, aside from requiring a very great deal of skill.

So called "self-packing" mats have hitherto been made by substantially increasing the thickness of the flong. This has two effects. It enables more of the embossing deformation to occur in the thickness of the flong, and it makes the dried flong stiffer and more resistant to deflection under the pressure of the molten type metal in the casting operation. But self-packing mats are not of universal application, and in any event, increasing the thickness of the flong greatly increases the cost of stereotype mats.

The prior art has hitherto done considerable work in an endeavor to eliminate the "packing" operation with flongs of usual thickness by superposing on the rear surface of the flong, before molding, some material of initially substantial caliper which will be capable of being considerably flattened or compressed by the extra pressure at the printing characters so as to premit the proper molding of the flong, but which elsewhere and in the non-print areas will exert enough resistance to compression to provide a backing for the flong in the non-print areas during casting, to prevent distortion of the flong. Use has been suggested of a material which changes its character between the molding operation and the drying operation, e.g. a material containing a polymerizable or thermosetting resin which permits the packing layer to be relatively soft and compressible during the molding operation, but which causes it to become hard and relatively incompressible in the non-print areas by the time the flong is dried under heat. It is not only expensive to attempt to change the qualities of a packing material as indicated, but it introduces features of necessary and rather delicate control in the operation of producing stereotype mats.

It is an object of this invention to provide a material which can be used in conjunction with a flong and which will provide an adequate packing layer for the purposes set forth, without reliance on changes in compressibility during molding, drying, casting and the like.

It has been suggested that a layer of felted paper or paperboard such as chipboard be embossed so as to present rugosities effectively increasing the overall caliper of the layer, and that such an embossed product be used in connection with a flong. In theory, the rugosities would flatten out over the printing areas thus enabling the flong to reproduce with accuracy the printing surfaces, whereas the rugosities would stand up in the non-printing areas with sufficient rigidity to support these areas of the flong against opposite deflection during the casting operation. Such theoretical operation has not been attained in practice. Various difficulties are encountered. One of these is the fact that the rugosities do not perfectly flatten out, resulting in printing characters which are rough because of non-uniform printing level. A pattern derived from the

rugosities appears in the areas of half-tones or other large printing surfaces for all-over ink impressions. The rugosities where uncompressed frequently do not adequately support the flong during casting. Also delamination is likely to occur between the flong and the backing sheet, undoubtedly due in part to a mismatch in the shrinkabilities of the materials.

It has been suggested that stretchable creped paper bodies, if indented with the formation of regularly spaced small protuberances on both sides, would better serve the purpose. In the best embodiment of such suggestions embossed or indented crepe paper materials have been coated with adhesive substances on the tips of the indentations upon one side; and a sheet of the indented crepe paper product has been placed against the moist flong with the tip coated side adjacent the flong during the molding operation. Some improvement can be attained in this way, but the difficulties have not hitherto been entirely obviated.

An additional difficulty encountered in the use of tip coated indented creped materials becomes most readily apparent during and after the molding operation in halftone areas and the like where the indentations must be entirely or substantially entirely flattened out. Tip coating interferes with the proper flattening of the indentations, and also provides areas of extra thickness even when the material has been flattened. This tends to form a pattern. Also a failure of the adhesive bond between the tip coated crepe paper backing mat and the flong has a tendency to occur, and in some instances the crepe paper mat becomes wrinkled so that the printing areas of halftones and the like may acquire an uneven surface in the ultimate plate.

An indented product has a greater surface area; and one of the basic problems to which this invention is addressed is the provision of an indented product of such character that the indentations may be flattened out in the printing areas without the production of a pattern, but with the maintenance of adequate adhesive union with the flong. It is an object of this invention to provide a crepe paper backing or packing mat structure and a composite stereotype mat made therewith in which this problem is solved and the above difficulties are obviated.

Additional objects of the invention include the provision of a stronger mat which will give improved performance during molding, the provision of a packing mat having a shrinkage compatible with the shrinkage of the flong during the drying operation, and the provision of a packing mat having an improved performance as respects the packing function.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, are accomplished by that structure and arrangement of parts and in that procedure of which an exemplary embodiment will now be described. Reference is made to the accompanying drawings wherein:

FIGS. 1 and 1*a* are perspective views of pieces of universally stretchable creped paper having indented patterns suitable for the practice of this invention.

FIG. 2 is a semi-diagrammatic, partial cross sectional view illustrating the molding operation in the formation of a packed stereotype mat in accordance with this invention.

FIG. 3 is a diagrammatic, partial cross sectional view illustrative of the mode of drying the stereotype mat.

FIG. 4 is a diagrammatic cross sectional view showing the casting of type metal against the curved, dried and shrunk mat.

The flong material employed may be the same cellulosic sheet material (formed on a cylinder mold or other paper machine) as is used in the formation of stereotype mats requiring hand packing. The flong will be used in the same moistened condition as is current in the art, it being understood by the skilled worker that a moisture

content is necessary to develop sufficient plasticity in the flong to permit molding and to stimulate shrinkage. The thickness or caliper of the flong, the precise materials of which it is manufactured, and the specific moisture content of the flong at the time it is used may be those current in the art and do not constitute limitations upon the present invention, excepting as set forth in the appended claims. It is an advantage of the invention, however, that thinner flongs may be used with consequent savings in cost. Flong thicknesses of substantially 26 to 37 mils are preferred.

The packing mat of this invention is made from universally stretchable paper. Other types of webs can be used, but the webs are preferably creped and characterized by crossing sets of creping crinkles or gatherings of exceedingly fine and uniform nature. Such webs of paper can be made in accordance with the teachings of one or more of the following patents:

W. C. Kemp, No. 2,008,181, issued July 16, 1935
W. C. Kemp, No. 2,008,182, issued July 16, 1935
W. C. Kemp, No. 2,071,347, issued Feb. 23, 1937
W. W. Rowe, No. 2,399,256, issued Apr. 30, 1946
P. W. Dorst, No. 2,494,334, issued Jan. 10, 1950
W. W. Rowe, No. 2,567,967, issued Sept. 18, 1951
W. W. Rowe, No. 2,610,935, issued Sept. 16, 1952
W. W. Rowe, No. 2,998,841, issued Sept. 5, 1961

Webs so formed are creped by means of a very thin layer of a positive creping adhesive which does not appreciably adversely affect the porosity and permeability of the paper. The crinkles or gatherings formed in the paper webs are exceedingly fine and uniform; and in preferred instances the webs are characterized by virtual smoothness or the visual absence of creping crinkles on the side coming against the creping drum (see Patent 2,610,935), while having visually detectable creping crinkles on the other side. The paper materials used in the form of the creped webs may be any desired, and may be formed of any of the chemical or mechanical pulps current in the art of which the fibers are uniformly small in diameter. Ordinary kraft papers are very suitable as a starting material.

There is likewise no strict limitation upon the basis weight before creping of the paper employed. It will be understood that the double diagonally creped papers which form the body of the preferred packing mat hereinafter more fully described may be so creped as to acquire varying degrees of lateral and longitudinal stretchability. It is preferred to have a high degree of stretchability and a substantially uniform degree of stretchability in both directions. Generally speaking, satisfactory backings mats may be made from papers which before creping have a basis weight or about 60# per ream, and which after creping have a basis weight of about 140#. Heavier or lighter papers may be employed if desired, and within such limits as are set by economy.

Stretchabilities of at least about 50% in both the longitudinal and lateral directions are desired, and have been found to comport with indented patterns such as are illustrated in FIGS. 1 and 1*a* and later described herein. Greater amounts of lateral and longitudinal stretchability may be employed; and it is necessary to have some residual stretchability in the creping crinkles after indenting. In other words, the indenting operation should not remove the creping crinkles entirely, but on the contrary there should be a residue of stretchability in the creping crinkles so that the crinkles can furnish incipient fold lines upon which the indentations or protuberances of the indent product can fold or contract upon crushing. Stretchabilities exceeding about 100%, however, are not ordinarily necessary or economical.

It does not constitute a departure from the spirit of the invention to use a mat comprising two or more layers of paper adhered together before or after creping. The preference is for a single layer or web of creped paper, excepting that in certain products a layer or layers of un-

indented creped paper may be combined with a layer or layers of indented creped paper.

The creped paper product will be indented with the formation of protuberances on one or both sides of the sheet. The indenting may be accomplished in a press with suitably configured platens; but it is entirely satisfactory and economical to run the double diagonally creped paper through a pair of rolls which have pins or projections on their surfaces, the pins of one roll interdigitating with the pins of the opposite roll. It is also possible to make an indented product by passing the crepe paper between a roll with pins on its surface and an opposed roll covered with rubber or other deformable substance, to form a "one-sided" indented product as shown in FIG. 1*a*.

There is importance in the size, shape and spacing of the protuberances formed in the crepe paper product. The indented product should have an overall thickness which will be sufficient for backing purposes, i.e. which will be sufficient to provide packing or support for the flong in the non-printing areas of the mat; and the protuberances should be of sufficiently small size to permit adequate molding while furnishing adequate support. In no case should the protuberances be such as to tend to produce inequalities, irregularities or patterns in the molded side of the flong. Without limitation, excellent results have been obtained by passing the double diagonally crepe paper between a pair of rolls the surfaces of each of which are studded with pins arranged in crossing helical rows about ¼ inch on centers, i.e. so as to produce protuberances on the sheet, which protuberances occur at a rate of about 4 to the linear inch.

In a particular embodiment, the bodies of the pins had a polygonal cross section, but the outer ends of the pins were slightly rounded. It will be understood that the rolls were so oriented and geared together that each pin of one roll interdigitated with and was surrounded by four pins of the opposite roll excepting, of course, at the extreme edges of the pattern. The pins in the exemplary instance had a length of approximately 1/16 inch; and it was possible to vary the depth of the indentations to a certain extent by adjusting the axial distance of the rolls. The crepe paper readily embosses without tearing because of its universal stretchability hereinabove described. The product made as last described is a "two-sided" embossed product as shown in FIG. 1.

It is necessary to use an adhesive between the embossed crepe paper backing mat and the flong. It is desirable to use an adhesive which will be non-tacky under ordinary atmospheric conditions for ease in handling, storage and shipment. Since the flong will be molded in a moistened condition, but generally at normal or room temperature, it is most convenient to employ an adhesive which will be moisture sensitive. It does not constitute a departure from the spirit of the invention to employ an adhesive which combines moisture sensitivity with some degree of heat sensitivity. However, for reasons later set forth it is advisable to use an adhesive which is relatively hard and rigid under normal atmospheric conditions.

A wide range of adhesives is available including but without limitation fish and animal glues, adhesives on a starch base, water-soluble vinyl or polyvinyl compounds and the like.

The adhesives used for joining the packing sheet to the flong should be distinguished from the adhesive used in the creping operation, and for this reason it will hereinafter be referred to as the "coating adhesive." While many of the creping adhesives set forth in the patents mentioned above may be employed in binding the paper to the creping drum, and while one may also use as a creping adhesive any of the coating adhesives just set forth, the quantity of creping adhesive is ordinarily very small and insufficient to bind the packing mat to the flong. Moreover, the creping adhesive, although ordinarily applied in the form of a water emulsion or latex, does not have to be an adhesive which will be water-sensitive after initial drying.

The paper will be creped with a suitable creping adhesive and thereafter coated with the coating adhesive. The coating may be applied by rolling, knifing or spraying to the creped paper before indenting; and if the creped paper has one substantially smooth side, the coating adhesive will preferably be applied to that side. Knifing or roll coating are preferred, and spraying of a kind which would tend to leave a coating which is spotty or non-uniform in thickness is not desirable. Tip coating, a coating which covers less than the whole area of the sheet, or any other form of non-uniform coating, should be avoided.

In FIG. 1 there is indicated a creped paper product **1** characterized (as the result of an indentation treatment) by a series of spaced protuberances **2** on one side of the web. It will be noted that the opposite side of the web is characterized by a series of intermediate or offset protuberances **3**. In FIG. 1*a* there is shown a one-sided embossed product **4** made by the second procedure outlined above, and characterized by protuberances **5** extending from one side only of the sheet.

Reference to FIG. 2 shows a press having a lower movable platen **6** and an upper pressure roller **7**. A chase **8** is mounted or positioned on the lower platen and contains printing characters such as will provide typescript areas **9**, half-tone areas **10** and various areas **11** which may be designated as non-print areas. A flong **12** in suitably moistened condition will be laid over the chase, and an indented packing mat **13** will be laid over the flong. Over the packing mat there will be placed any suitable type of unitary or composite pressure pad. The nature of the pressure pad may be the same as those in current commercial use, and does not constitute a necessary limitation on the invention. It is worthwhile pointing out that the pad need have no great deformability in the direction of its thickness since, when a packing pad is used, the pressure pad does not follow the contour of the upper side of the molded flong. A satisfactory pressure pad usually consists of a flexible polyvinyl film **14** having a thickness of about 38 mils, a stainless steel sheet **15** having a thickness of about .025 inch, and a layer **16** of milled Bakelite board about .125 inch thickness. In the prior art molding of ordinary flongs, it has been the practice to use a pressure pad embodying a cork-faced metal sheet. The cork is relatively highly compressible and it acts to deform the flong rather deeply into the non-print areas. In the use of prior art "packless mats" relatively incompressible pressure pads have been used. It is desirable in the practice of this invention to use a pressure pad which, as described above, is intermediate these extremes. In any event it is well to avoid a pressure pad which has so high a compressibility as to act to completely flatten out the indentations or protuberances of the packing sheet in the non-print areas.

In the use of an indented creped paper as an automatic packing mat, it will be evident that when sufficient pressure is applied in the press diagrammatically indicated in FIG. 2, the identations of the crepe paper will be flattened out or collapsed over an area corresponding to the half-tone area **10**. In an area corresponding to the typescript area **9**, the indentations of the crepe paper will be flattened out in part and will remain in part so as to cause the flong **12** to be molded to the configuration of the upper ends of the type characters. In an area opposite the area **11** (which is a non-printing area within the chase) the indentations of the crepe paper backing mat should remain substantially as illustrated, in order to give adequate support to the flong during casting. This does not mean, of course, that there cannot be some compression or diminution in the height of the protuberances; but the fact remains that the effective thickness of the self-packing mat over areas such as the area

11 must remain at least as great as the distance of the depression of the flong above the area 11.

FIG. 3 diagrammatically illustrates the operation of drying the stereotype mat. It will be bent into an arcuate configuration as shown and placed in a well known machine against a foraminous arcuate support 17 the curvature of which will be such as to bring the molded surface of the flong 12 to a partly cylindrical conformation appropriate for the making of curved plates for rotary printing presses. A portion of the housing of the machine is indicated at 18 and the skilled worker in the art will understand that a relatively low vacuum may be drawn against the convex surface of the mat by exhausting the space between the housing 18 and the support 17 through a suitable port or ports. Sources of heat 19 which may be of any sort desired are located on the concave side of the stereotype mat and if desired additional sources of heat may be employed beyond the outer or convex surface of the stereotype mat as at 20.

The actual casting of the type metal against the stereotype mat, illustrated in FIG. 4, is conventional. The casting box will have an outer casing 21 configured to support the curved, packed mat; and the type metal 22 will be cast between the mat and an inner core member 23.

While the mode of manufacture of a satisfactory packing mat, its use with a flong, and the operations of molding, drying and casting have been generally outlined above, there are certain factors which must be taken into consideration in the successful practice of the invention. These factors are as follows:

(1) The "printing level" must be substantially the same throughout all printing surfaces in the stereotype mat. While in some commercial operations a variation in printing level up to about .006 inch can be tolerated, it is greatly preferred that the printing level be accurate to within plus or minus .003 inch. This means that the nature of the packing mat must be such as to transmit the high pressures at the printing surfaces during molding to the flong with great accuracy so that the flong can be caused to respond substantially perfectly to the printing surfaces. Any condition which would tend to transmit or "telegraph" a pattern derived from the indentations of the embossed stretchable packing mat through the surface of the flong will interfere with the perfection of the printing level in the finished mat.

(2) The finished, molded and dried mat must have a satisfactory "space depth" sufficient for the type of printing being done. Space depth is defined as the distance between the highest and lowest surface portions of the flong on the casting side, or in other words, the distance between the printing surfaces of the finished plate and the surface level of the non-printing areas. The space depth in open areas of the mat should produce about .025 inch in the plate, and greater space depths are to be preferred. The term space depth is applied not only to the levels of flong deflection between adjacent printing characters when compared with the level of the printing surfaces themselves, but also to those relatively large non-printing areas which are to be found in newspaper pages and other printed matter where the deflected flong must be adequately supported against the pressure of the molten type metal.

(3) The stretchable paper web or webs must be characterized by fine and uniform creping crinkles or other gatherings by which the paper is rendered stretchable. If such gatherings are large enough to telegraph a pattern through the flong at the printing areas, the stereotype mat will be unsatisfactory. By fine creping crinkles or other gatherings is meant at least about 50 creping crinkles per lineal inch in the direction across the crinkles. It may be understood that the stretchable paper even if indented will be substantially flattened out over the printing areas, and if the paper is characterized by gatherings substantially greater than the dimension given, these gatherings can themselves telegraph a pattern through to the surface of a flong of conventional thickness.

(4) It is characteristic of moistened and molded flongs that they will shrink upon drying. The shrinkage of the flong itself in different directions is basically a matter of the nature of the flong itself. The shrinkages involved may run from ¼ inch to 1⅛ inches over a distance of about 16½ inches on the face of the flong. Such shrinkages are highly desirable because they reduce the necessary sizes of the printing plates and permit substantial savings in the paper used for printing newspapers by way of example. But the backing material employed must be compatible with the shrinking of the flong.

(5) The matter of shrinkage requires more extensive consideration by reason of the complexity of the actions which occur. It is characteristic of the indented stretchable papers disclosed herein that they are susceptible to shrinkage and in fact have a greater tendency to shrink than is characteristic of the flongs themselves. When prepared for use, the flongs will be moist in the sense that they may contain around 28% of moisture. Thus the flongs are in an expanded condition. While it does not constitute a departure from the present invention to moisten or condition the indented crepe paper packing sheet prior to its association with the flong, it is not necessary to do this and on the whole it is undesirable for two reasons: it involves an extra processing step, and it may tend to decrease the crush resistance of the indentations. Consequently in the preferred practice of the procedure a packing sheet in a commercially dry condition is laid over the moist flong and the molding is accomplished as soon thereafter as is practicable. The molding results in a flattening out of the indentations or protuberances of the packing sheet, for example, over the printing area of a half-tone or other printing indicia. Because the indented packing sheet bears a uniform coating of adhesive over the whole of the area of its surface lying next the flong, the flattened crepe paper is adhered solidly to the flong over the areas where the protuberances have been entirely flattened out. In such areas thereafter the expansion and shrinkage of the crepe paper will be found to follow the shrinkage of the flong. Although it is inevitable that the stretchable paper packing sheet will absorb some moisture from the flong, in the areas of solid adhesion the tendency of the creped paper to expand does not produce delamination. Since the flong is already in an expanded condition the crepe paper will be kept from expanding further in the solidly cemented areas; but when the flong dries and therefore shrinks, the crepe paper will shrink with it and without pulling away from the surface of the flong. This may be termed "passive shrinkage."

In non-print areas where the indented crepe paper is not solidly cemented to the flong, the indented crepe paper will tend to expand, particularly in large non-print areas and will "pillow" or apparently leave the surface of the flong if any great time passes between the molding and the drying. Nevertheless, upon drying the indented crepe paper will tend to shrink more than the flong and will tension itself across such areas. This may be termed "active shrinkage."

Thus the packing sheet of this invention does not interfere with the shrinkage behavior of the flong itself in any substantial way. If a greater degree of shrinkage is desired in the mats of this invention, it is usually only necessary to moisten the flong to a slightly greater degree although flong materials having enhanced shrinkage characteristics may be produced if desired.

The effects described above, however, will not be obtained unless the indented crepe paper product carries an all over uniform coating of adhesive and unless the protuberances are capable of being flattened out completely as described.

(6) The nature of the protuberances formed by the indenting operation is of importance. It is necessary that these protuberances flatten out completely in the printing area so that the creped paper is reduced to at most its original thickness without the formation of laps or folds

which would telegraph patterns through to the surface of the flong in these areas. It is necessary as aforesaid that the creped paper contract by a reforming of the original fine crinkles. The protuberances must have residual stretchability as previously pointed out. Protuberances of such shape as to tend to mushroom or form extraneous folds or laps during the crushing are not suitable for use in the invention. Best results are obtained from protuberances which are slightly pyramidal or conical in cross section, i.e. protuberances having sloping sides. The effective thickness of the indented crepe paper sheet should be greater than the desired space depth of the molded, dried and shrunk mat.

(7) The adhesive should be tacky at the time of the molding. Tip coating, however, is undesirable as such, because if the adhesive is located only at or adjacent the tips of the protuberances, these islands of adhesive will themselves form areas of greater thickness when the protuberances are crushed, making for a thickness pattern which may telegraph through to the outer surface of the flong in the printing areas. Also, if the indentations or protuberances are only partially coated they are rendered differently crushable in different parts, and this increases the tendency to form laps or folds. As has previously been stated, the coating of adhesive substance should be uniform over the entire surface of the indented creped paper packing mats. This causes the protuberances to collapse or crush in a uniform way in the print areas.

Where the creped paper product is coated before indenting, and the adhesive dried, it will be noted that the adhesive may tend to crack or split at or adjacent the peaks of the protuberances. This contributes to the porosity of the indented creped paper product and probably has a beneficial effect on the passage of moisture-vapor through the indented creped paper product making both wetting and drying easier. It has not, however, been found that porosity gained in this way is necessary in the drying operation. The term "uniform coating" as used herein takes into account this possible cracking or splitting.

But certain other effects of the overall coating of the product are worthy of note. First, as the protuberances crush in the printing areas, an increasing area of adhesive comes into contact with the flong thus tending to increase bond. Second, the adhesive itself, covering the entire surface of the indented product tends to control the shrinkage of the creped paper and to match it more nearly to the shrinkage of the flong. Dry weights of coating adhesive which have been found entirely satisfactory are from about 10# to about 25# per ream (3000 square feet). The weight of adhesive chosen can be influenced by the desired bond and by considerations of support in the casting machine, since an adhesive coated protuberance has an enhanced stiffness and resistance to crushing in the dried condition.

By following the teachings hereinabove set forth perfectly molded and packed mats are currently being formed. By mats which are perfectly molded is meant mats which have an excellent "printing level," mats free of any pattern derived from the indented creped paper product, mats which have an adequate space depth as defined, mats which maintain the space depth against the pressure of molten metal during casting thereby substantially eliminating the necessity of hand packing, and mats which meet the shrinkage requirements of the flongs in commercial use.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A backing sheet for packing a stereotype mat consisting essentially of a web of universally stretchable paper of essentially uniform thickness having a multiplicity of gatherings which are sufficiently fine to avoid folding into multiple thicknesses when the sheet is applied to the back of a stereotype mat and compressed as the mat is molded, said sheet being indented on at least one side thereof to provide a series of uniform protuberances, said sheet bearing on one indented surface thereof a uniformly distributed coating of a moisture sensitive adhesive which uniformly covers both the protuberances and the areas of the sheet between said protuberances, said sheet being characterized by resident gatherings which persist after indentation and upon which said protuberances may collapse as the mat and backing are subjected to molding pressure, whereby the said collapsed areas will return to the original uniform thickness of the sheet.

2. The backing sheet claimed in claim **1** wherein said sheet consists of crepe paper having crossing sets of creping crinkles.

3. The backing sheet claimed in claim **2** wherein said crepe paper is double diagonally creped and is characterized by a visually smooth side and an opposite side in which the creping gatherings are visually apparent, and in which the said adhesive coating is on the visually smooth side of the crepe paper.

4. The backing sheet claimed in claim **1** wherein said protuberances extend to one side only of said sheet, the said protuberances being at least about 1/16 inch in height and spaced on centers such that there are about four protuberances per lineal inch of the indented sheet.

5. The backing sheet claimed in claim **1** wherein the sheet is so indented that protuberances extend from both sides of it, the said protuberances being so formed that there are about four protuberances per lineal inch on each side of the said sheet.

6. The backing sheet claimed in claim **1** in which the said protuberances have bases and top portions, said top portions being rounded and being smaller in cross-section than the said bases.

7. A process for making a backing sheet for a stereotype mat which comprises the steps of:

(a) providing a sheet of universally stretchable paper of essentially uniform thickness having a multiplicity of gatherings which are sufficiently fine to avoid folding into multiple thicknesses when the sheet is compressed during the molding of a stereotype mat,

(b) coating one side of the sheet with a uniformly distributed layer of a moisture sensitive adhesive,

(c) drying said adhesive, and

(d) thereafter indenting said coated sheet to form protuberances on at least one side thereof projecting outwardly from the coated side of the sheet, said protuberances being indented to a uniform depth, including the step of limiting the depth of the protuberances to the extent that resident gatherings remain in the sheet after indentation upon which said protuberances may collapse under molding pressures to return such collapsed areas to the original uniform thickness of the sheet.

8. The method claimed in claim **7** wherein said sheet comprises crepe paper characterized by crossing sets of creping crinkles with a visually smooth side and an opposite side in which the creping crinkles are visually apparent, wherein said adhesive is applied to the visually smooth side of said sheet, and wherein said sheet is indented from one side only to provide protuberances on the smooth side of the sheet.

9. The method claimed in claim **8** wherein said protuberances are at least about 1/16 inch in height and spaced on centers such that there are about four protuberances per lineal inch of the indented sheet.

References Cited

UNITED STATES PATENTS

1,525,172	2/1925	Eberhard	161—400
2,071,347	2/1937	Kemp	161—129
2,257,428	9/1941	Ruegenberg	161—128
2,610,935	9/1952	Howe	161—128
3,001,899	9/1961	Hansen et al.	161—129

MORRIS SUSSMAN, *Primary Examiner.*