Oct. 10, 1939. L. E. HOOGSTOEL 2,175,773

PROCESS OF MAKING GASKETS

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Fig. 1.

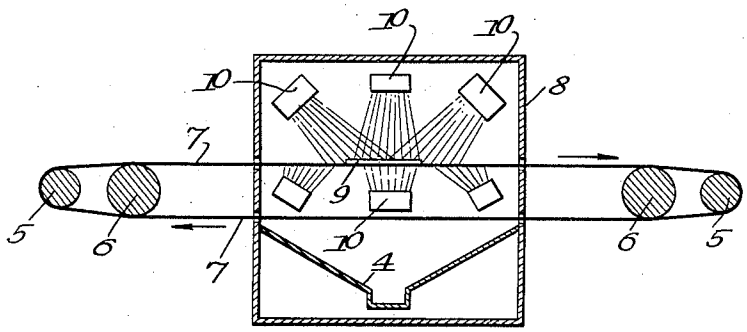
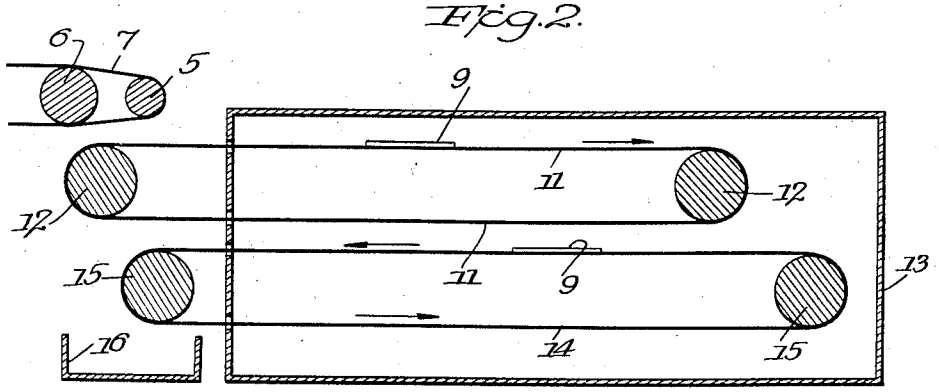


Fig. 2.



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PROCESS OF MAKING GASKETS

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5 Claims. (Cl. 91—68)

This invention relates to rings, ellipses, squares, oblongs and various irregular shaped objects made from paper and paper-like or similar cellulosic webs saturated with a liquid medium consisting of or containing agents which swell cellulose. With regard to its more specific features, the invention is concerned with the manufacture of gaskets from paper or similar cellulosic webs saturated with a binder which consists of or contains agents which swell paper. By the term "paper" I mean a web consisting essentially of the usual paper-making vegetable fibers or a web containing such fibers in an amount sufficient to cause dimensional changes upon permeation or impregnation and having associated therewith comminuted cork or leather or other modifying agents.

It is an object of this invention to produce a gasket or other article which is highly resistant to the passage of grease, oil, gasoline and similar solvents and which is generally resistant to water. Still another object of the invention is the economical production of a gasket or similar article with tolerances in dimensions which are sufficiently accurate for commercial purposes. Still another object of the invention is the accomplishment of one or more of the foregoing purposes along with the recovery of the chemicals in the waste and the return of the waste paper freed from chemicals to the beater of the paper making machine for further use in the making of paper. Another object of the invention is to provide a practical process by which one or more of the objects mentioned may be readily accomplished. Other objects will be in part obvious or in part pointed out hereafter.

When gaskets and similar objects are made from the types of paper herein described, saturated with a solution of glue, glycerine and water, the method has been to saturate a web of the paper, tan the glue and dry, or dry and subsequently tan, after which the gaskets are cut from the dried, tanned, saturated web of paper. This process is very wasteful in that the area of material used in the gaskets is small as compared with the spaces in between the gaskets and the area cut out within the gasket perimeter. Wastes in excess of 25% are common and in many cases the waste is well in excess of 50%, even though an effort is made to use the pieces cut out from inside the gaskets to form still smaller gaskets.

The chemicals used in the saturation of the paper form a substantial part of the raw material cost and it is an object of the present invention to save all or a considerable part of the chemicals that have heretofore been wasted. Furthermore, waste paper cuttings in the past have not been adapted to re-use in the paper-making machine without special processing because they contained insolublized protein. In the present processes the paper scrap is suitable for re-use in the paper-making machine and therefore a considerable proportion of the base paper cost may be saved by returning the waste paper to the beater.

The present invention is based upon the discovery that there is no appreciable dimensional change incident to the tanning operation even though a water solution of formaldehyde or similar water solution is used in this operation.

As stated before, it has been the practice of the prior art to tan the binder and then cut the gaskets or other desired articles from the web. Where this is done the recovery of the chemicals becomes very difficult and in some cases impossible. Furthermore, the waste paper cuttings are not suitable for use in the paper beating machine without special treatment to remove the insolubilized binder.

I avoid these difficulties of the prior art by (1) cutting the gaskets from the saturated paper-like web, and (2) after drying, subsequently tanning the gaskets or other articles cut from the said web.

In carrying out the invention, I make use of any known machine for the production of paper from stock, as for example, a Fourdrinier machine or a cylinder machine. I provide as a base paper stock, any suitable furnish, for example, rope, chemical wood pulp, purified wood pulp, jute, or combinations thereof, and I may also use a certain amount of cotton or linen fiber.

The manufacture of saturating papers for use in the manufacture of gaskets by saturating the paper with a water solution of glue-glycerine and subsequently tanning, is well known in the art. In general I find papers made for use in the existing processes of the prior art satisfactory for use in my process. Various gauges of paper are used in the manufacture of gaskets and I use various gauges in my process. A suitable illustration of an all-fiber paper, satisfactory for my process, may conform to the following specifications:

Gauge	inch	.023
Basis weight	pounds	194
Basis weight per mil of thickness	do	8.4
Glue test, not to exceed	seconds	21

The glue test is run by saturating the paper with a solution of 1 part glue, 3½ parts glycerine and 7½ parts water at 120 degrees Fahrenheit, using in the solution a grease-free bone glue of 38–40 millipoises in viscosity as determined by the standard method of the National Association of Glue Manufacturers. The test is carried out by forming a boat of the paper and dropping it on top of the solution and observing the time required for the glue solution to penetrate through the paper. Such a paper may well be prepared from a fiber furnish consisting of 1 part by weight of rope to 2 parts by weight of jute, but

other fibers may be used and the proportion of rope to jute may be varied or the paper may be made solely of one kind of fibers.

I also find that paper made according to the patent of Elmer C. Schacht, No. 1,888,409, issued November 22, 1932, is very satisfactory. As stated in the aforesaid patent to Schacht, such a paper may be prepared from jute, rope, hemp, sisal, kraft pulp fibers, cotton, linen, and long wood pulp fibers, as well as absorbent alpha-cellulose wood pulp fibers, and these fibers are mixed in a beater with the comminuted cork to produce the furnish which is subsequently felted on a paper-making machine to form a light, porous, saturating paper.

In addition to or in lieu of cork I may use other modifying agents along with the usual paper-making fibers such as for instance, disintegrated leather, the use of which is well known in the art.

I have conducted many tests with a variety of samples of commercial saturating paper and find that in the saturating process there is an increase in the cross dimension of the paper varying from about 1 to 2.5 per cent, a change which is equivalent to 1 to 2½ inches per 100 inches of dimension in the gasket material in the cross direction. With such papers the change in the length or machine direction is usually relatively small, or in fact there may sometimes be a slight shrinkage rather than an expansion in the length direction. It is obvious that if a gasket were precut from such paper and subsequently saturated, a circular gasket would become an ellipse after saturation and furthermore that the dimensions of the finished gasket would not be within accepted tolerances for gasket sizes for various applications.

The characteristics of the cork fibre paper used in the processings given herein by way of illustration, are as follows:

Gauge .0115 inch paper:		
Ream weight	pounds	70
Glue saturation test, not over	seconds	18
Furnish—		
28–150 mesh cork	per cent	15
48–150 mesh cork	do	25
Jute	do	38
Rope	do	22
Gauge .0165 inch paper:		
Ream weight	pounds	97
Glue saturation test, not over	seconds	19
Furnish—		
28–150 mesh cork	per cent	15
48–150 mesh cork	do	25
Jute	do	38
Rope	do	22
Gauge .033 inch paper:		
Ream weight	pounds	188
Glue saturation test, not over	seconds	25
Furnish—		
28–150 mesh cork	per cent	40
28–48 mesh cork	do	5
Jute	do	35
Rope	do	20
Gauge .048 inch paper:		
Ream weight	pounds	265
Glue saturation test, not over	seconds	33
Furnish—		
28–150 mesh cork	per cent	40
28–48 mesh cork	do	5
Jute	do	35
Rope	do	22

As a binder for my process I may use a solution of bone glue and glycerine or of bone glue and sorbitol and subsequently tan the glue. Furthermore, I may use hide glues and a part or all of the glue may be replaced by casein.

I saturate the webs with these binders in accordance with the methods known in the art. A suitable apparatus of the prior art and method of using the same is described in United States Patent No. 1,904,087 issued to Elmer C. Schacht, April 18, 1933, except that I do not tan the glue or casein, if such is used, as illustrated in the aforesaid apparatus and method of the patent to Elmer C. Schacht. Instead of passing the saturated web from the cooling chamber through the formaldehyde, I pass the web either directly from the saturating tank to the drying racks or directly from the cooling chamber to the drying racks.

The web so saturated is dried to bring it to equilibrium with average atmospheric humidities and temperatures such as for instance, a relative humidity of 50 per cent and a temperature of 70 degrees Fahrenheit. When the web is in such a condition or at any time thereafter when it is in a similar condition, I cut the desired articles such as gaskets and the like from the saturated web and then tan the glue in the gaskets or other articles from the web by immersing them in a 5 per cent formaldehyde solution or otherwise subjecting them to formaldehyde vapor or liquid or some equivalent tanning agent, as for instance paraformaldehyde or tannic acid. While usually not preferred, potassium chromate or chrome alum may be used.

The waste cuttings from the web are subjected to a leaching, as for instance with warm water, to remove the greater part of the glue and glycerin. The leaching liquor is squeezed or otherwise removed from the paper cuttings and is either used directly in making up new binder solutions or is concentrated as by a vacuum evaporation to remove part or most of the water, and is then re-used in making new binder solutions. The waste paper cuttings are suitable for reuse in the beater of the paper-making machine and are usually so used.

The operations of the present invention include the saturation of a web containing a substantial proportion of cellulosic fibers, the drying of the saturated web, the cutting of gaskets or other articles from the dried saturated web, and the subsequent tanning or insolubilizing of the binder. As stated before, saturating equipment and drying equipment shown in the previously mentioned patent to Elmer C. Schacht are suitable for my purpose. The gaskets are cut by conventional dies such as are now used in the art or by any other suitable means. The tanning operation may be carried out by hand or other suitable methods. Where it is desired to carry out the tanning and subsequent drying of the gaskets or other articles in a continuous manner, apparatus shown diagrammatically in the accompanying drawing may be used to advantage but many other types of machines may be employed with equal success.

In the accompanying drawing:

Figure 1 is a diagrammatic vertical sectional view of a portion of a machine adapted to carry out my process.

Figure 2 is a similar view of another portion of the apparatus.

Referring to Figure 1, the gaskets or other articles 9 are dumped upon a continuous wire belt

7 carried by rolls 5 and also spread and otherwise supported by rolls 6. The belt 7 travels through a chamber 8 within which are located suitable spray nozzles 10 from which a 5 per cent solution of formaldehyde, preferably cooled, as for instance to a temperature of about 40° Fahrenheit, is sprayed onto both the tops and the bottoms of the gaskets or other articles so as to tan or insolubilize the glutinous or similar binder. The excess of tanning solution may be collected by a drainage system 4. From the wire belt 7 of Figure 1, the gaskets or other articles are dumped upon the steel belt 11 of Figure 2.

Referring to Figure 2, as before stated 11 of Figure 2 represents a steel belt upon which the gaskets or other articles 9 are dumped from the belt 7 of Figure 1 either directly or by some convenient connecting means. Steel belt 11 is carried by rolls 12 and the belt extends into a drying chamber 13. At the end of the travel of belt 11 the gaskets or other articles 9 are dumped upon another steel belt 14 within the drying chamber and trained about rolls 15. The gaskets or other articles are conveyed by the last mentioned belt lengthwise of the drying chamber and outwardly therefrom. They may be deposited in any suitable container 16 after their complete travel through the drying chamber. The chamber 13 should be kept at a suitable temperature, preferably not in excess of 90 degrees Fahrenheit, a good range being between 85 and 90 degrees Fahrenheit. Many well known methods of heating the chamber may be used but it is preferred to circulate heated air therethrough, discarding part of the circulated air and adding new warm air to keep the humidity range between 30 and 40 per cent. The humidity range may, however, be varied within wide limits, depending upon the rate of drying desired.

As an illustration of my invention I will describe the results obtained with a web of cork fiber paper of .0115 inch gauge which was saturated at 120 degrees Fahrenheit with a solution of 1 part glue, 3½ parts glycerine and 7½ parts water. After the web was saturated with this solution it was dried and brought to equilibrium with a relative humidity of 50 per cent and a temperature of 70 degrees Fahrenheit. Gaskets were cut from the saturated and dried web, and subsequently tanned by immersion in a 5 per cent solution of formaldehyde in water and again dried to equilibrium with 50 per cent relative humidity and at a temperature of 70 degrees Fahrenheit, such humidities and temperatures being representative of more or less average atmospheric conditions. The final tanned, dried gasket had a dimension in the length direction of the paper which was 0.2 per cent less than the same dimension in the untanned gasket and a dimension in the cross direction of the gasket which was 0.05 per cent less than the same dimension in the untanned gasket. Such changes are well within the allowable tolerances for gaskets.

As a control experiment a blank was cut from the same unsaturated web of paper. The blank was then saturated with the same glue solution as that used in the preceding experiment, cooled, tanned and dried. The finished gasket had a dimension in the length direction of the paper which was 0.16 per cent greater than the same dimension in the pre-cut, unsaturated blank and a dimension in the cross direction of the paper which was 2.31 per cent greater than the same dimension in the pre-cut unsaturated blank. Such differences are well outside of commercial tolerances for gaskets.

As a further illustration of my invention, a web of cork fiber paper of .024 inch gauge was saturated at 120 degrees Fahrenheit with a solution of 1 part glue, 3½ parts glycerine and 7½ parts water. The saturated web was dried and brought to equilibrium with 50 per cent relative humidity and a temperature of 70 degrees Fahrenheit. Gaskets were cut from the web so prepared and tanned by spraying with a solution of 5 per cent formaldehyde in water, dried and brought to equilibrium at 50 per cent relative humidity and a temperature of 70 degrees Fahrenheit. The final tanned, conditioned gasket had a dimension in the length direction of the paper which was 0.01 per cent less than the same dimension in the untanned gasket and a dimension in the cross direction of the paper which was 0.04 per cent less than the same dimension in the untanned gasket. Such changes in dimensions are obviously negligible as compared with the commercial tolerances allowed in gaskets and such articles.

Another control experiment was made in which a blank or unsaturated gasket was cut from the raw paper stock, saturated with the same binder solution, cooled, tanned, dried and brought to equilibrium with 50 per cent relative humidity and a temperature of 70 degrees Fahrenheit. In this control experiment the final gasket had a dimension in the length direction of the paper which was 0.22 per cent less than the same dimension in the unsaturated blank and a dimension in the cross direction of the paper which was 1.83 per cent more than the same dimension in the unsaturated blank. Such variations are not within commercial tolerances.

As a still further illustration of my invention, some of my results with cork fiber paper of .048 inch gauge will be described. The paper web was saturated using 1 part glue, 3½ parts glycerine and 7½ parts water at a temperature of 120 degrees Fahrenheit. The saturated web was dried and brought to equilibrium with a relative humidity of 50 per cent and a temperature of 70 degrees Fahrenheit. Gaskets were cut from the web so prepared and tanned by immersing in a 5 per cent solution of formaldehyde in water. After immersing in the formaldehyde the gaskets were dried and brought to equilibrium with a relative humidity of 50 per cent and a temperature of 70 degrees Fahrenheit. Gaskets so made had a dimension in the length direction of the paper which was 0.02 per cent less than the same dimension in the untanned, conditioned gasket, and a dimension in the cross direction of the paper which was identical with the same dimension in the untanned, saturated gasket. These differences are negligible.

As a control experiment, a blank was cut from the same base cork fiber paper, saturated with the same glue solution as that described in the preceding experiment, cooled, tanned and dried to equilibrium with a relative humidity of 50 per cent and a temperature of 70 degrees Fahrenheit. In this control experiment where my invention was not used, the final gasket had a dimension in the length direction of the paper which was 0.06 per cent greater than the same dimension in the unsaturated paper blank and a dimension in the cross direction of the paper which was 1.52 per cent greater than the same dimension in the unsaturated paper blank. Such variations are not acceptable as good commercial practice.

In still other experiments, saturating papers

made with a furnish consisting of about 1 part rope and 2 parts jute were used and similar results were obtained.

In still further variations of my invention cork fiber paper and paper consisting essentially of 1 part rope and 2 parts jute were saturated with a binder consisting of 1 part glue, 3½ parts sorbitol and 7½ parts water. Results similar to those previously described were obtained. In all cases the final tanned gaskets or other articles had dimensions and shapes which did not differ substantially from the dimensions and the shapes of the saturated untanned gaskets or other articles.

As an illustration of the removal of the saturating chemicals from the waste cuttings in order to salvage the saturating chemicals and to prepare the fibers for re-use in the paper beating machine, results of extracting the chemicals from .0115 inch, .024 inch and .048 inch cork and fiber gasket material will be described. The saturated cuttings were subjected to a conventional warm water leaching, i. e., a leaching with water at a temperature of about 150 degrees Fahrenheit. The leaching solution retained in the paper was squeezed from the paper and allowed to flow back into the main body of leaching solution simultaneously with the removal of the paper from the leaching process. Roughly, 99 per cent of the chemicals were recovered in the form of a solution containing 1 per cent solids.

By proceeding similarly with the .024 inch saturated paper cuttings, about 98 per cent of the chemicals were recovered in the form of a solution containing 1 per cent solids

In a similar manner the .048 inch saturated paper cuttings were leached and about 97 per cent of the chemicals were recovered in the form of a solution containing 1 per cent solids.

Since in the foregoing cases the cuttings were about 50 per cent of the original saturated paper web, the solution was concentrated by vacuum evaporation to one consisting of approximately 1 part glue, 3½ parts glycerine and 15 parts water. To this solution was added sufficient glue and glycerine to bring the strength up to a solution containing 1 part glue, 3½ parts glycerine and 7½ parts water, this being the solution that it was desired to use in saturating paper to make additional gaskets.

In general in my process I re-use the extracted chemicals in making new saturating solutions and it is therefore only necessary to remove a part of the leaching water as for instance, enough water to permit the utilization of all the recovered chemicals in making new saturating solutions.

I may, however, if desired, and especially where it is intended to keep the extracted chemicals for a considerable time before using, remove the greater part of the water to produce a glue and glycerine jelly which can be held in a refrigerated condition to prevent it from spoiling.

Sometimes it will be more economical to use less leaching water and to recover a smaller percentage of the chemicals from the waste cuttings and obtain them in a more concentrated form, thus obviating the necessity of removing so much water. In some cases by proceeding in this way I may avoid the necessity of concentrating the solution before it is used.

Where casein is used in lieu of bone or hide blue the leaching water used to extract the casein should contain some form of alkali, a suitable alkali being ammonia dissolved in the leaching water.

It will be seen that the methods of the present invention provide practical processes of manufacturing saturated gaskets and other articles from paper and paper-like webs containing a substantial proportion of cellulosic fibers and a binder which swells cellulosic fibers such as a glutinous or similar binder flexibilized with glycerine or sorbitol and the like which make possible the recovery of a substantial proportion of the chemicals which have heretofore been lost in the waste cuttings and which also make possible the ready re-use of the paper recovered from the waste cuttings in a paper beating machine to form new paper. It has not been recognized heretofore that there is no substantial change in the dimensions or shape of a gasket or other article cut from paper-like webs that have been saturated with flexibilized glutinous and similar binders upon the subsequent insolubilizing or tanning of the binder even through a solution of formaldehyde in water or equivalent tanning medium is used. Since the gaskets or other articles are cut before the binder is insolubilized, recovery of the binder without subjecting it to destructive chemicals which would render it unfit for use or injure it is readily carried out.

The sorbitol used in certain examples of this invention is a grade sold by the Atlas Powder Company. It is a thick viscous syrup of commercial grade containing about 83 per cent sorbitol, the balance being water except for about 1 per cent of sodium sulphate and about 0.75 per cent of glucose.

In saturating the webs containing a substantial proportion of cellulosic fibers in accordance with the various forms of this invention, different percentages of binder are incorporated in the web, the amount of binder used depending, for instance, upon the paper, the binder and the intended use of the article. For many purposes, however, dried binder to the extent of from about 80 to 100 per cent of the base paper weight will be found satisfactory.

The terms "saturating" and "impregnating" are used throughout the specification and claims in a generic sense to cover the incorporation of a suitable amount of a saturating or impregnating agent in the body of the paper, as distinguished from mere surface painting or coating.

I claim:

1. A process of making saturated gaskets of predetermined size and shape from paper-like webs including cellulosic fibers in an amount to cause the webs to change dimensions upon saturation with a binder solution which swells cellulose, comprising saturating the web with a binder solution containing a flexibilizing agent, and a material selected from the classes consisting of bone glues, hide glues and casein, drying the saturated web to produce a saturated web at least the cross dimension of which differs substantially from the same dimension of the untreated web, cutting gaskets of definite predetermined size and shape therefrom and subsequently tanning the binder within the gaskets so cut to produce gaskets of the same size and shape as the gaskets cut from the untanned web whereby the saturating materials in the waste remain untanned and may be recovered for re-use and whereby the scrap paper may be re-processed.

2. A process of making saturated gaskets of pre-determined size and shape from paper-like webs including cellulosic fibers in an amount to cause the webs to change dimensions upon

saturation with a binder solution which swells cellulose, comprising saturating the web with a binder solution containing glycerine, and a material selected from the classes consisting of bone glues, hide glues and casein, drying the saturated web to produce a saturated web at least the cross dimension of which differs substantially from the same dimension of the untreated web, cutting gaskets of definite pre-determined size and shape therefrom and subsequently tanning the binder within the gaskets so cut to produce gaskets of the same size and shape as the gaskets cut from the untanned web whereby the saturating materials in the waste remain untanned and may be recovered for re-use and whereby the scrap paper may be re-processed.

3. A process of making saturated gaskets of pre-determined size and shape from paper-like webs including cellulosic fibers in an amount to cause the webs to change dimensions upon saturation with a binder solution which swells cellulose, comprising saturating the web with a binder solution containing sorbitol, and a material selected from the classes consisting of bone glues, hide glues and casein, drying the saturated web to produce a saturated web at least the cross dimension of which differs substantially from the same dimension of the untreated web, cutting gaskets of definite pre-determined size and shape therefrom and subsequently tanning the binder within the gaskets so cut to produce gaskets of the same size and shape as the gaskets cut from the untanned web whereby the saturating materials in the waste remain untanned and may be recovered for re-use and whereby the scrap paper may be re-processed.

4. A process of making saturated gaskets of pre-determined size and shape from paper-like webs including cellulosic fibers in an amount to cause the paper to change dimensions upon saturation with a binder solution containing animal glue and glycerine dissolved in water, comprising saturating the web with a binder solution containing glycerine and animal glue dissolved in water, drying the saturated web to produce a saturated web at least the cross dimension of which differs substantially from the same dimension of the untreated web, cutting gaskets of definite pre-determined size and shape therefrom and subsequently tanning the animal glue within the gaskets so cut to produce gaskets of the same size and shape as the gaskets cut from the untanned web whereby the saturating materials in the waste remain untanned and may be recovered for re-use and whereby the scrap paper may be re-processed.

5. A process of making saturated gaskets of pre-determined size and shape from paper-like webs including cellulosic fibers in an amount to cause the paper to change dimensions upon saturation with a binder solution containing animal glue and sorbitol dissolved in water, comprising saturating the web with a binder solution containing sorbitol and animal glue dissolved in water, drying the saturated web to produce a saturated web at least the cross dimension of which differs substantially from the same dimension of the untreated web, cutting gaskets of definite pre-determined size and shape therefrom and subsequently tanning the animal glue within the gaskets so cut to produce gaskets of the same size and shape as the gaskets cut from the untanned web whereby the saturating materials in the waste remain untanned and may be recovered for re-use and whereby the scrap paper may be re-processed.

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