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PROCESS FOR MAKING LEATHER SHEETS

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My invention relates generally to products containing leather and to process of making the same, and particularly to products of this type the principal ingredient of which is ground, torn, shredded or comminuted leather, and to a process of manufacturing these products in part on an ordinary paper making machine. This application is a continuation in part of my co-pending application "Leather products and processes of making the same," Serial No. 724,618, filed May 8, 1934.

An important object of my invention is to provide sheet material of the character indicated having leather as its principal ingredient, the said sheet being highly absorbent and at the same time relatively dense and opaque in comparison to similar sheets of common absorbent paper being manufactured at the present time for imitation leather purposes.

It is also an important object of my invention to provide a process of making products of the character indicated consisting in forming the same on an ordinary paper making machine and subsequently impregnating the products to give the products the desired finish and texture.

It is also an important object of my invention to provide products of the character indicated by the method of manufacture stated, which have the feel, odor, appearance and other characteristics of genuine leather and are capable of being subsequently impregnated with vulcanizable and unvulcanizable binders and body forming materials.

Another important object of my invention is to provide leather-containing or all-leather sheets of the character indicated above which are not subject to "air-size."

It is also an important object of my invention to provide in a process of the character indicated above, steps producing vulcanization of the products subsequent to impregnation with vulcanizable material, the said steps applying equally well to products containing only leather as well as products containing other substances as well.

Other objects and advantages of my invention will be apparent from a reading of the following description and explanation wherein for purposes of illustration I have set forth preferred embodiments of my invention.

The present invention contemplates the formation of material of the character indicated in sheet form having an all-leather content of tanned ground leather or a combination of paper making fibres and tanned ground leather fibres,

free from lumps, in any suitable proportions on an ordinary paper making machine, whereby to produce an absorbent sheet or body having a smooth surface, a long fibre, and having the odor, appearance, and feel of leather, and adapted to be subsequently impregnated with binding and body producing solutions like, or containing latex, vultex, vulcanizable latex, dispersed rubber, rubber cement, in conjunction with gums or other adhesive substances, such as tragacanth, karaya, locust bean, casein, glue, natural and synthetic gums, related emulsions and the like viscose or cellulose solutions with or without plasticizers, nitrated or otherwise.

The product as it comes from the paper making machine is susceptible to treatment with rubber cements (having inflammable solvents) as subsequently described herein.

Absorbent papers mad from alpha, kraft and rope, and of other related substances have heretofore been made for conversion into imitation leather bases by impregnation with different types of compounds and compositions. These papers were usually coated with cellulose compounds, embossed and sold to the trade as a leather substitute. There is now a great demand for leather substitutes in certain industries, notably in the shoe industry, but the presently available substitutes lack certain qualities which are inherent in genuine leather, such as fluffiness, softness, leather odor, feel, appearance and strength. With the exception of certain rope reinforced stocks, the presently available leather substitutes lack useful strength.

Leather substitutes made from paper are objectionably ununiform and are translucent and when held up to the light disclose a blotchy web.

The products of the present invention in contrast to those alluded to above, have all of the desirable leather qualities, and when held up to the light, no transparency whatever is observable, the formation of the web being very dense. Despite this dense character the products are highly absorbent, and this highly absorbent yet dense character is due to the type of fibres and treatment used.

It is obvious that the availability of leather substitutes made of all-leather fibres or a combination of leather and paper fibres having the advantages and desirable characteristics indicated should create an enormous demand for the same, in view of the present lack of any capable or of any attractive substitute for leather.

The coarse or long fibres used in my process are obtained by selecting the finest of bark tan-

nages of shoe sole scrap and, by means of a very intricate mechanical device, so shredding or tearing these fibres that they retain a long, soft, fibrous construction of fibre.

The fine or short fibres used in the present invention are obtained by selecting a different grade of leather from that used in obtaining the long fibres, such as that used for upper stock and grinding it through a different type of intricate mechanical device to produce a uniform length of soft, absorbent powdery fibre.

It will be understood that the grinding, shredding or tearing of this leather is no simple matter and must be carried out along definite scientific and mechanical lines with due regard being given to the chemical and physical constitution of these fibres so that they will not be burned or suffer other injury rendering them unsuitable for the purpose intended. The actual fact that the long fibres and short fibres cannot be produced on the same machine proves the delicacy of this operation and the accuracy necessary for proper results.

It is not possible to use ordinary scrap for the purposes of the present invention because such scrap contains large quantities of impurities such as sand and emery dust, and leather dust from a variety of different tannages and different colored leathers, so it is obvious that very special attention must be given to selecting and producing the proper kinds of disintegrated leather to be used if a satisfactory sheet is to be produced.

Ordinary scrap could be made into a sheet by screening out the undesirable parts but this would produce only an unsatisfactory sheet lacking uniformity, because of the different varieties of tannages used, and the other impurities referred to which it contains. Ordinary scrap consists principally of leather dust secured by sanding or buffing various kinds of leather.

The available physical characteristics and dimensions of the coarse and of the fine leather fibres are as follows:

	Per cent
Material passed through a 20 mesh screen; that is, a wire screen having 20 openings per inch.....	100
By weight failed to pass a 28 mesh screen.....	5
Passed the 28 mesh screen but was retained on the 40 mesh.....	3.4
Passed the 40 mesh screen; retained on the 50 mesh.....	5.1
Passed the 50 mesh; retained on 80 mesh.....	7.3
Passed the 80 mesh; retained on 200 mesh.....	8.8
Passed through the 200 mesh screen.....	44.7
	100.0

The various fractions separated in this way were found to differ considerably in their appearance under the microscope.

The material which was retained on the 28 mesh screen consisted practically entirely of fibers of fairly uniform diameter, namely, about 0.004 to 0.008 millimeter. These fibers varied somewhat in length, but were mostly 0.8 and 1.6 millimeters in length. There were also in this fraction a number of loose aggregates or bundles of fibers, as well as a number of very fine fibers or "fibrils."

The fraction passing the 50 mesh screen and left on the 80 mesh screen consisted chiefly of

clumps of very short fibers of about the same diameter as above, but having an average approximate length between 0.2 and 0.6 millimeter as nearly as they could be measured.

The fraction passing the 80 mesh screen and retained on the 100 mesh consisted of fibers together with a considerable proportion of small pieces of skin tissue of widely varying shape and size, but mostly, roughly two or three times longer than the width, the largest diameter averaging between 0.2 and 0.4 millimeter.

The fraction passing through the 200 mesh screen, which constituted almost one-half of the material by weight is chiefly fine dust, which is apparently composed of bits of skin tissue, very short fiber fragments, etc. They are mostly, approximately round or oval in shape. The largest particles may be about 0.1 millimeter in their largest dimension, while the great majority of the particles appear to be between 0.03 and 0.05 millimeter in their largest diameter.

Turning to the coarse material, it was found impossible to subject this to a screen analysis owing to the readiness with which this material forms into flocks or balls of fiber.

As far as could be judged this sample consists almost entirely of fibers, although there appears to be a small amount of very short fibers and dust. The length of fibers varies over a very wide range, but apparently most of them are of the order of several millimeters in length. If the fiber is opened or picked apart by hand it is possible to shake out a number of short fibers, and we have found some material which will pass even a 200 mesh screen. A determination of the average fiber length or the distribution of particle size in this sample would be extremely difficult.

The two samples differ also in their bulk density, by which we mean the volume occupied by a given weight of the material. The fine sample when loosely packed has a bulk density of 12.3 pounds per cubic foot, while the coarse sample under the same conditions weighs 6.1 lbs. per cubic foot. It is, therefore, evident that the fine sample is almost exactly twice as dense as the coarse. Other experiments in which the materials were packed under higher pressure indicated almost exactly the same relation between the two samples.

The dry bark tanned shoe sole scrap is selected and put into the disintegrating machine which is equipped with a special shredding roll and tearing device which both shreds and tears, leaving the fibres long and silky and of a very uniform length. It is, of course, impossible to disintegrate leather without some useless matter being present so the stock is first screened to take out the coarse untouched nubs and is then put through a metal shaft consisting of baffles with a forced draft, which takes out even the finest unshredded particles and leaves the resultant fibres perfectly clean and ready to be used as a constituent of a leather sheet in accordance with the present invention.

The upper stock leather is selected for proper tannage color and condition and is then ground in dry form through a special grinding apparatus, which grinds without burning the tender leather fibres, and is then screened and put through the baffles for cleaning out the fine nubs. After going through these baffles, it is then ready to be used as a constituent of leather sheet in accordance with the present invention.

Beaten fibres utilized prior to the present in-

vention are those fibres that are beaten in wet form in a mechanical beater. Very little attention is given to what type of leather fibres is used and they are seldom selected. But assuming that the same stock as used in the present invention was selected for beating purposes, it is evident that the fibres must be disintegrated in the wet form before they could be run into a sheet with or without a mixture of other fibres. The beating of these wet fibres to a point where they would be suitable to run on a paper making machine would, undoubtedly, take about 12 hours if everything went well, but in order to thoroughly eliminate the nubs that resist disintegration it might take 24 hours to eliminate them sufficiently so that a run could be made. Even then this beaten stock would still contain imperfectly beaten nubs that could cause lumps and specks in the sheet to the extent that it might become necessary to sand the surface to eliminate these nubs. The beaten fibres being wet they could not be screened or put through forced draft to remove nubs and other impurities. Considering the above description of the beater method, and the difficulties surrounding this method including the time required for disintegration by beating and the fact that only an imperfect result is possible by the beaten method, it is evident that a lot of work must be done to secure an imperfect job.

Beating a lot of leather for 12 hours has a tendency to hydrate the leather to the point where it becomes non-absorbent, so that where it is necessary to beat it for 24 hours the result is obvious; so that as a matter of fact, an absorbent sheet cannot be obtained where the fibres are beaten in a mechanical beater for such periods of time.

The properly ground, torn or shredded fibres of the present invention do not require any beating, so that they retain their absorbency and all that is necessary to produce an absorbent sheet from these all-leather fibres or from a combination of these leather fibres and paper making fibres is to simply mix the fibres together in a mixer with water so as to get a uniform distribution of leather fibres throughout the slurry or mix, Jordan, and then to run the sheet on the paper making machine. The time required for mixing the leather fibres with the paper making fibres is only approximately three-quarters of an hour as against twelve hours upwards in the case of processes involving beating the leather.

The torn, ground, or shredded fibres, of the present invention contain no bothersome or unground nubs, the whole fibre structure being uniform. Therefore, whether run as 100% leather fibres or as a combination of leather fibres and paper making fibres, the sheet is absolutely free from lumps. The beating referred to above is a long drawn out process besides destroying the absorbency, and is unreliable at best, whereas the previously ground, shredded or torn fibres of the present invention are ready for instant use, and they have full saturating qualities and produce a very reliable and uniform sheet.

Experience in the manufacture of these leather sheets, shows that the best coarse tanned leather fibres for producing a sheet is obtained by tearing and shredding selected bark tanned shoe sole scrap. In manufacturing a sheet where the finely ground or comminuted leather is used, certain types of tanned upper stock are found best. In both cases, the shredding, tearing or grinding methods described above produce fibres entirely

free from nubs or lumps because the disintegrated stock is first screened and then put through baffles under forced draft so as to eliminate impurities or unpulverized particles.

In view of the foregoing the importance is apparent to distinguish between a sheet whose leather fibres are beaten or disintegrated in the beater wet and a leather sheet whose dry fibres are previously ground, torn, shredded or comminuted and required no beating or further disintegration to produce the sheet.

Heretofore, no ground, torn, shredded or comminuted leather has been available for manufacturing a sheet of the type as disclosed in this application. Not only are the ground, torn, shredded or comminuted leather fibres distinctly advantageous in the manufacture of a sheet, but the fibres, taken together with the method of manufacture, produce a sheet far superior and without parallel for saturating purposes.

No leather sheet, no matter how well made or by the method of beating it in the beater while wet from the raw stock unground could possibly produce a sheet that would in any way compare with my idea because it would not be capable of being saturated, and without having saturating qualities it is absolutely worthless as a substitute for leather.

It should also be noted that the sheet is made without any type of binding material whatsoever. It contains nothing but the leather fibres themselves, and because of the fact that no binding material of any description is used during the actual manufacture of the sheet itself, it is apparent that there is nothing contained in the sheet at this stage to prevent saturation thereof and that a sheet made in accordance with the following described methods, is quite absorbent and capable of being impregnated with numerous kinds of materials. To put it plainly, this sheet is made without binder and is subsequently impregnated with binders.

Following the disintegration operation, the tanned leather fibres whether of coarse texture or of finely ground texture are ready to use in the formation of either a 100% leather fibre sheet or in conjunction with paper making fibres.

For instance, if it is desired to produce a sheet consisting of 100% leather fibres, 500 gallons (4250 lbs.) of water is run into a mixer, to which is added an alkaline solution which has been previously dissolved in some warm water. The object of adding this alkaline solution is to eliminate the natural oils and greases which the leather contains. The alkaline solution having been added to the 500 gallons of water, I then add 600 lbs (dry weight) of the previously ground, torn, shredded or comminuted tanned leather fibres which have been previously soaked in water while in the bags. As soon as these 600 lbs. (dry weight) of the previously soaked leather fibres are put into the mixer containing the 500 gallons of water, and mixed, a test is made to determine the pH reading. This should not exceed 5.5 because the leather paper will not permit of saturation if it is on or near the alkaline side. If the pH is over 5.5, an acid is added, for instance, vitriol to bring the pH to between 4.5 and 5.5. About one quart of the above acid in ten quarts of water is required to be added to the above described quantity of leather fibres if the pH should happen to read over 6 to 6.5.

Now having established the pH reading, sufficient water is added to bring this slurry to a workable condition, for example, 96½% water

and 3½% of tanned leather fibres. The proportion of alkaline solution depends upon the type and condition of the ground, torn, shredded or comminuted leather used, but for general purposes ⅓ of 1% to 1% of the alkaline solution is used based upon the pounds of water and pounds of leather involved. It has been found under actual manufacturing conditions that an alkaline solution of material known as "Alkanol B" which is the sodium salt of naphthalene sulphononic acid derivative, can be used to the best advantage. It is a cream colored powder which is readily soluble in warm or hot water. It is very soluble in alcohol and acetone but is insoluble in most other organic solvents. It is an extremely efficient wetting agent in concentrations as low as ⅓% and as high as 1% and will wet all fibres and surfaces practically instantaneously. "Alkanol B" has no detergent effect except as it acts as an emulsifying agent for solvents and detergents. Such alkaline solutions as caustic soda, soda ash or other alkalis can be used but the use of "Alkanol B" works out considerably cheaper and more effectively.

While the alkaline solution is necessary for the removal of oils and greases contained in the leather, it has been found that the leather paper must be on the acid side to afford proper absorption. Therefore, it is very important that the pulp or slurry should have the proper pH reading before it is run on the paper making machine.

The theory of the action of alkaline wetting-out agents is that they break down the surface tension as well as dissolve the oil and grease and thus allow penetration of liquids. In the case of previously ground leather, I have found that they not only allow the leather to be quickly and uniformly wet with water so that it will mix up well, but furthermore they allow the production of a leather paper that does not subsequently "air size." In other words, they permit of the manufacture of a leather product which will retain its absorbent properties over a long period of time which is really the most important point of all.

The leather fibres having been wet and having had the oils and grease removed through the use of the alkaline solution and having been acidified to the proper pH reading of 5.5 and water having been added so that the slurry contains about 96½% of water and 3½% of tanned leather fibres, the slurry is thoroughly and continuously mixed until a homogeneous mass is obtained. This takes approximately a half hour, after which the slurry is pumped through a Jordan or refiner for the specific purpose of refining the fibres so as to obtain a better formation on the paper making machine. They are then pumped to the paper making machine through screens to remove impurities such as dirt and strings which may have become mixed with the fibres during the preparation of the same.

The stock then flows onto the "endless" wire of the regular paper making machine (whether Fourdrinier or cylinder). Here a large proportion of the water is drained off by gravity and suction and the web then formed as it leaves the "endless" wire of the regular paper making machine but is not "wet pressed" as is a regular paper but allowed to pass directly to the paper making dryers. The elimination of "wet pressing" insures a softer, more absorbent, bulkier type of sheet.

It should be observed that when making a sheet consisting of 100% tanned leather fibres that the heat of the drying cans should not exceed 150 degrees Fahrenheit because of the liability of

burning the tender leather fibres while they are being dried around the cans. After being dried around the cans, the sheet goes to the calender where it is run through a sufficient number of rolls to soften and smooth up the surface and give it the proper thickness, after which it is slit and wound on a core in whatever width may be required.

There has been no mention of binder because here no binder is used in the formation of the slurry nor is there any spraying of rubber or use of coagulant during the manufacture of the sheet. The slurry is run exactly like paper with the exceptions noted.

Leather and paper making fibre sheet

The manufacture of a sheet consisting of previously ground, torn, shredded or comminuted tanned leather fibres and paper making fibres is quite simple.

Assuming the manufacture of a sheet consisting of 60% paper making fibres (10% Manila rope fibres and 50% wood pulp "sulphate" fibres) and 40% previously tanned leather fibres, I proceed as follows:

Both fibres are cooked separately, the rope fibres requiring a different treatment from the wood pulp fibres. After being cooked these fibres are mixed together in the proportion of 600 gallons of water and approximating 720 lbs. (dry weight) of the mixed paper making fibres. The 60% or 720 lbs. (dry weight) of mixed paper making fibres are strongly alkaline. The object of mixing them together is to determine their pH reading and to thoroughly commingle them. These paper making fibres are now washed in clear water until the pH reading is 10 and the mixer is then stopped.

In the meantime, 40% or 480 lbs. (dry weight) of the previously ground, torn, shredded or comminuted tanned leather fibres which have been previously soaked in water overnight in the bags are prepared as follows:

400 gallons of water are run into a mixer to which is added ⅓ of 1% and as high as 1% of the alkaline solution (in this instance "Alkanol B") which has been previously dissolved in a small amount of warm water. The mixer is then run continuously for about ten minutes to thoroughly mingle the water and the alkaline substance. Now the 480 lbs. (dry weight) of ground, torn, shredded or comminuted tanned leather fibres, having been previously soaked, are dumped into these 400 gals. of water containing this alkaline substance and are again run continuously for about ten minutes to mix the tanned leather fibres. As soon as this amalgamation has taken place, the 720 lbs. of paper making fibres thoroughly mixed as described above, are added to the tanned leather fibres in the mixer and the mixer is run again for a period of approximately twenty minutes to thoroughly amalgamate the paper making fibres with the tanned leather fibres. At this time a test is made to determine the pH reading. If the pH reading is over 5.5, an acid is added, for example, vitriol to bring the pH reading between 4.5 and 5.5. Different amounts of acids are necessary for each batch because leathers differ. However, about one quart of acid in ten quarts of water will suffice as an illustration. Now having established the pH reading, sufficient water is added to bring this pulp or slurry to a workable condition, such as 96½% water and 3½% mixed tanned leather and paper making fibres.

While the alkaline treatment as applied to the tanned leather fibres and the paper making fibres is necessary to remove oils, greases, lignins and the like, it has been found that this combination of paper making and tanned leather fibres must be on the acid side to produce proper absorption, therefore, the addition of vitriol above referred to. It is very important that the pulp or slurry should have the proper pH reading, namely, approximately from 4.5 to 5.5 in order that it may be run successfully on the paper making machine and have proper absorption qualities.

The alkaline solution acts also as a wetting-out agent and serves to break down surface tension as well as dissolve the oils, greases, lignins and the like and permits better penetration of liquids and furthermore, it permits the production of a sheet consisting of previously ground, shredded, torn or comminuted leather fibres and paper making fibres which does not subsequently "air size." This means that the sheet can be stored indefinitely and still retain its absorbent properties which is really the most important point.

Having prepared the paper making fibres and the tanned leather fibres and mixed them into a homogeneous mass, and determined the pH reading, and diluted the slurry to the point where it consists of approximately 96½% of water and 3½% of tanned leather fibres and paper making fibres, this slurry is now ready to run on the paper making machine, and is pumped through a Jordan or refiner for the specific purpose of refining the fibres so as to obtain a better formation on the paper making machine, and it is then pumped to the paper making machine through screens acting to remove impurities such as dirt and strings which may have become mixed with the fibres during the preparation of the same.

The stock flows onto an "endless" wire of the regular paper making machine (whether Fourdrinier or cylinder). Here a large proportion of the water is drained off by gravity and suction but the web thus formed as it leaves the "endless" wire of the regular paper making machine is not "wet pressed" as is ordinary paper but it is allowed to pass directly to the paper making dryers. The elimination of "wet pressing" insures a softer, more absorbent and bulkier type of sheet. It is not necessary to observe the same conditions as to heat as when making a sheet of 100% tanned leather fibres because the paper making fibres do not char as do the tender leather fibres and these paper making fibres act as an insulator and prevent the heat in the cans from burning the tender leather fibres.

After being dried around the cans, the sheet goes to the calender where it is run through a sufficient number of rolls to soften it and smooth up the surface and give it the proper thickness, after which it is slit and wound on a core of whatever width may be required.

It is to be noted that here as in the case of 100% tanned leather fibre sheet no binder is used in the formation of the slurry and no spraying of rubber or any other binder takes place and that no use of coagulant or fillers attends the manufacture of the sheet. It is run exactly like paper with the exceptions noted.

It should also be noted that when a sheet is made in accordance with the above processes described herein whether of 100% previously ground tanned leather fibres or of a combination of previously ground tanned leather fibres and paper

making fibres, it can be kept in storage indefinitely and will still be capable of being impregnated as easily and perfectly as when freshly made. The method of making either or both of these sheets provides for the removal and elimination of oils, greases, lignins and other resinous substances whose tendency it is to prevent saturation, but this is not necessary in all cases.

Having succeeded in making the two types of sheets commercially in accordance with the above descriptions, each of these sheets is ready for impregnation, neither having been up to this point in any way altered by any impregnation, spraying or containing any binder or filling materials whatsoever.

To make an absorbent sheet is one thing and to impregnate it is another. The above described sheet made without binder is very absorbent and can be made in any desired width of roll or thickness of sheet from .010 to .070 of an inch thick, any thickness of which can be impregnated at any time. The difference between this sheet and sheets covered by prior processes is that the end achieved here is to make an absorbent sheet from previously ground, torn, shredded, or comminuted unbeaten tanned leather fibres or previously ground, torn, shredded, or comminuted unbeaten tanned leather fibres in combination with paper making fibres that can be carried in stock as long as required and can be impregnated at any time, due to the fact that it does not "air size." When it comes off the machine it is not impregnated but can be impregnated at any time to meet current needs with any impregnating compound to make different types of products. The non-impregnated material is not cut up into sheets. It is carried in rolls of various yardages up to 2000 yards according to thickness, so that when it needs to be impregnated for some particular purpose it can be very effectively handled.

If, however, it is desired to make a leather paper containing other substances besides leather, in addition to the hemp rope and wood pulp (sulphate) paper making fibres before mentioned, such paper making fibres as cotton, rayon, rags, jute, sisal, long wood, Chinese or Oriental grass, or asbestos fibres may be employed. These paper making fibres are cooked and otherwise treated to procure maximum absorbency and are either added to the disintegrated leather or the leather is added to them in whatever proportions are considered proper to produce sheets of a given character.

Having made the above mentioned sheet free from binder with 40% leather fibres and 60% of paper making fibres, the impregnation of same is done as follows:

Without regard to the kind of impregnating materials used, the manner of impregnating and drying is substantially as follows:

A saturating machine being provided, a roll of all leather or combined leather and paper stock sheeting is placed upon the unwind stand and is then unrolled and immersed in the impregnating material in the tank and the surplus squeezed out between squeeze rolls or it is allowed to float upon the surface of the impregnating material as it moves along and the surplus is squeezed out with squeeze rolls or it is passed between two rollers containing a puddle of the impregnating material, which not only impregnate but squeeze out the surplus impregnating material. The sheeting then goes through the drying system containing usually a festoon, straight pass dryer, can dryer, steam coils or combination of same,

in continuously circulated hot air wherein the moisture is entirely dried out of the stock, which has just been impregnated. After it is dry, the impregnated sheeting is rolled into a bundle on an ordinary reeling machine and is then ready for the next step, whether it be combining, finishing, embossing or any handling which may be dictated by the purpose for which it is to be used.

The impregnating compound usually consists of some combination of either latex, "Vultex," rubber cement, dispersed rubber, or vulcanizable latex with some gum adhesive element such as one or more of those described above. It is the amount of solids which is left in the impregnated products which determine the quality thereof. It is possible to use as little as 2% of rubber and 98% of adhesive substance, and it is possible to obtain sheeting containing as much as 70% of solids.

The amounts of rubber and adhesive substance to be used will vary according to the results desired.

For instance, if a very firm rigid material is desired I impregnate the sheeting with a solution consisting of 14 gallons of rubber and 20 ounces (dry weight) of casein in 10 gallons of water with suitable aniline dye or pigment to add color. Should a softer material be desired, glycerine or other softening agent is added to the foregoing solution.

When it is desired to impregnate the sheeting with rubber cement or cement solutions made from reclaimed rubber or a combination of both, either with or without coloring and filling compounds, the impregnating substances are made by milling the rubber, fillers, and coloring compounds together and adding plasticizers on standard rubber millers, for softeners, and the resultants are then dissolved with the aid of gasoline, benzol or similar solvents in an agitator until a smooth heavy solution is obtained having the desired rubber content.

The method of impregnating the sheeting with such a rubber impregnating solution is as follows:

The roll of sheeting to be so impregnated is placed on the unwinding frame of the saturating machine and passed either through the solution in a tank or floated on the surface of the solution until thoroughly saturated and is then squeezed between rolls to remove the surplus solution; or passed through squeeze rolls where a heavy solution is thrown on the top side of the sheeting just before it goes through the rolls.

The passage of the sheeting through the squeeze rolls causes the solution to be squeezed into the sheeting and the surplus solution to be squeezed out.

The thus impregnated sheeting is then passed through the festoon dryer or passed through a straight pass or other type of dryer to pass off the vapors. The resultant sheeting is then vulcanized on both sides by exposing both sides of the impregnated sheet to the action of vapors of sulphur monochloride in a vulcanizing chamber accompanied by air circulation and heat operating to equalize the application of the sulphur monochloride vapors to the sheeting and thereby produce uniform vulcanization thereof.

In connection with vulcanizing the sheeting of the invention I have found that vulcanization may be achieved of either the all leather sheet or the combined sheet consisting of leather fibres and paper making fibres by the following method.

Either or both of the above mentioned sheets can be saturated with a rubber cement with or without reclaimed rubber compound containing vul-

canizing elements, the excess squeezed out and then passed through a dryer to dry out or evaporate the solvents after which it is passed through another enclosed compartment at slow speed where the temperature may run from 220 to 250 degrees Fahrenheit and there remain in the compartment exposed to the above heat for a period of from one to two hours. It is advantageous to have a current of air in the compartment and to have the stock pass through in continuous movement. An enclosed festoon is preferred, but other types of dryers can be utilized, for this work because the heats and speeds can be regulated to meet variable conditions.

It is to be understood that reference herein to combination of leather and paper fibres in the form of sheets is not intended to apply to woven fabrics and the like, but to include only either the all leather or combination leather and paper making fibre containing sheeting made on a Fourdrinier or cylinder machine.

Although I have shown and described herein preferred embodiments of my invention, it is to be definitely understood that I do not desire to limit the application of the invention thereto, and any change or changes may be made in the materials and in the manner of assembling the same, within the spirit of the invention and the scope of the subjoined claims.

What is claimed is:

1. A method of making an unsized binder-free permanently absorbent leather-containing sheet capable of subsequent impregnation, said method comprising providing a quantity of fibres, a portion of said fibres being short, fine unhydrated leather fibres obtained by dry grinding tanned scrap leather and another portion of said fibres being long, coarse unhydrated leather fibres obtained by dry shredding tanned scrap leather, then mixing said fibres with water to obtain a uniform distribution of the fibres in the resulting slurry, then adjusting the pH of the slurry to between 4.5 and 5.5, and then running said slurry on a paper making machine to form a sheet.

2. A method of making an unsized binder-free permanently absorbent leather-containing sheet capable of subsequent impregnation, said method comprising providing a quantity of fibres, a portion of said fibres being short, fine unhydrated leather fibres obtained by dry grinding tanned scrap leather and another portion of said fibres being long, coarse unhydrated leather fibres obtained by dry shredding tanned scrap leather and another portion of said fibres being paper making fibres, then mixing said fibres with water to obtain a uniform distribution of the fibres in the resulting slurry, then adjusting the pH of the slurry to between 4.5 and 5.5, and then running said slurry on a paper making machine to form a sheet.

3. A method of making an unsized binder-free permanently absorbent leather-containing sheet capable of subsequent impregnation, said method comprising providing a quantity of fibres, all of said fibres being unhydrated leather fibres obtained by dry grinding tanned scrap leather, then mixing said fibres with water containing an alkaline wetting agent for approximately three-quarters of an hour assuring definite subsequent absorptiveness while obtaining a uniform distribution of the fibres in the resulting slurry, then adjusting the pH of the slurry to between 4.5 to 5.5, then diluting the slurry to a paper making consistency, and then running said slurry on a paper making machine to form a sheet.

4. A method of making an imitation leather sheet, said method comprising providing a quantity of fibres, a portion of said fibres being short, fine unhydrated leather fibres obtained by dry grinding tanned scrap leather, another portion of said fibres being long, coarse unhydrated leather fibres obtained by dry shredding tanned scrap leather, then mixing said fibres with water to obtain a uniform distribution of the fibres in the resulting slurry, then adjusting the pH of the slurry to between 4.5 and 5.5, then running the slurry on a paper making machine to form a sheet, and thereafter impregnating said sheet with at least one of a group consisting of dispersed rubber, dispersed rubber with water soluble gum, dispersed rubber with natural resinous emulsions, dispersed rubber with synthetic resinous emulsions produced by the action of ammonia upon resinous bases.

5. A method of making an imitation leather sheet, said method comprising providing a quantity of fibres, a portion of said fibres being short, fine unhydrated leather fibres obtained by dry grinding tanned scrap leather, another portion of said fibres being long, coarse unhydrated leather fibres obtained by dry shredding tanned scrap leather, and another portion of said fibres being cooked paper making fibres mixed with water and having a pH approximating 10; mixing the leather fibres with water containing an alkaline wetting agent to obtain a uniform distribution of the leather fibres in the resulting

slurry; then to this slurry adding the batch of paper making fibres with mixing to obtain amalgamation of the leather fibres and the paper making fibres; then adjusting the pH of resultant slurry to between 4.5 and 5.5, then diluting the slurry to a paper making consistency, and then running the slurry on a paper making machine to form a sheet.

6. A method of making an imitation leather sheet, said method comprising providing a quantity of fibres, a portion of said fibres being short, fine unhydrated leather fibres obtained by dry grinding tanned scrap leather, another portion of said fibres being long, coarse unhydrated leather fibres obtained by dry shredding tanned scrap leather, and another portion of said fibres being cooked paper making fibres mixed with water and having a pH approximating 10; mixing the leather fibres with water containing an alkaline wetting agent to obtain a uniform distribution of the leather fibres in the resulting slurry; then to this slurry adding the batch of paper making fibres with mixing to obtain amalgamation of the leather fibres and the paper making fibres; then adjusting the pH of the resultant slurry to between 4.5 and 5.5, then diluting the slurry to a paper making consistency, and then running the slurry on a paper making machine to form a sheet, then subsequently impregnating the sheet with rubber.

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