

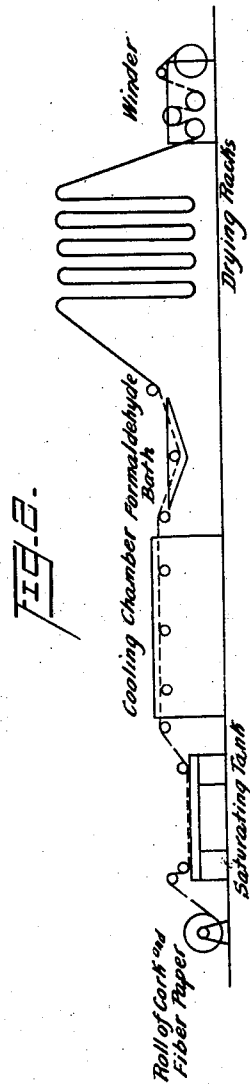
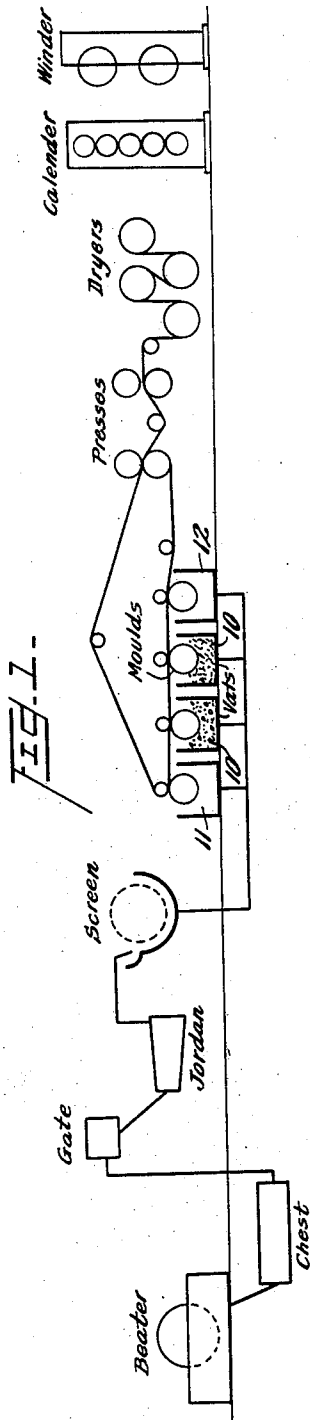
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PAPER MAKING PROCESS

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PAPER MAKING PROCESS

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The present invention relates to a method of manufacturing a paper-like sheet material, and particularly a sheet material of the character disclosed in my issued Patents, Nos. 1,888,409 and 1,888,410, both granted November 22, 1932; this application is a division of the applications resulting in the aforesaid patents.

The object of the invention is to produce a web consisting essentially of cork and fibres and permeated with or having insolubly and permanently incorporated throughout its structure a flexible binder. Such material is efficiently used in the manufacture of gaskets.

A further object of the invention is to form a laminated or stratified web comprising a layer of comminuted cork and fibres having bonded thereto as by felting a layer composed exclusively of fibres to produce a substantially integral structure. This composite web likewise throughout its structure is permeated with or has permanently and insolubly incorporated therein a flexible binder, and is useful in the manufacture of floor coverings and artificial leather.

The above products are characterized by (1) high tensile strength, (2) resilience, i. e. compressibility and rebound, and (3) flexibility and pliability in that the sheets may be sharply flexed or creased without cracking or the formation of weakened areas.

I attribute the excellent qualities of these products in part to the method employed in their manufacture. Webs of the structure described without a specially incorporated material will be resilient and cellular in varying degrees by reason of the presence of the cork, and strong because of the presence of the fibres, but are subject to cracking and formation of weak areas under sharp flexing. By the process now to be described, however, the first mentioned inherent qualities are improved very materially and, at the same time, the pliability and flexibility are developed to the point of unusual resistance to folding and bending strains, thereby widening the range of usefulness of the sheeted articles.

In addition to improving the pliability and

flexibility of the product by the process of saturation, its strength is greatly improved due to the addition of the binder and also the product can be oil proofed or water proofed according to the type and characteristics of the saturant employed.

Another object of the invention is to form a film or floating upon the sheet materials which will be selected for the intended purpose.

The figures of the drawing show diagrammatically one method of carrying out the invention by the use of a cylinder paper making machine and immersion apparatus in which the formed web is treated.

In carrying out the invention, I prepare in accordance with the paper making practice, a stock consisting of a separator, that is, comminuted cork, and fibres and sufficient water; in the case of the laminated structure, a stock composed substantially exclusively of fibres, is also prepared. By "separator", I mean a material of low specific gravity which is compressible and/or elastic, which preferably can be screened to a size and is of a character which will retain compressibility and size when wet or compressed and which continue to separate the contiguous fibres and preferably tend to cause them to return to their original position when pressure has been released. As a typical separator, I prefer comminuted cork.

The separator or comminuted cork should be of a size which may be termed "effective". That is to say, the cork granules to be effective should not exceed, in cross-section, the desired thickness of the finished sheet, nor should they be smaller in cross-section than the cross-sectional diameter of the fibres. Finer cork than this will act as a filler, thereby preventing the formation of voids and air cells, and also will be lost to a larger extent in the paper making process; likewise smaller particles would be ineffective in acting as separators and hinges about which the fibres can flex. I have used successfully cork particles of a grade from 50 to 150 mesh and 30 to 50 mesh.

The fibres with which the cork articles are mixed to form the web 10, should be sufficiently long (a) to contribute tearing strength to

the finished product, (b) to mesh and hold the "separating" particles, i. e. the cork, and (c) to make an absorbent paper, quickly permeable to saturating solutions. Specific examples of the fibres which I employ are:

Jute,	Absorbent alpha cellulose,
Rope,	Wood pulp fibres,
Hemp,	Cotton,
Sisal,	Linen,
Kraft pulp fibres,	Asbestos.
Long wood pulp fibres,	

The paper making process follows customary practice in that I use a Fourdrinier apparatus or a cylinder type machine, the latter being illustrated in the drawing.

In the manufacture of the stratified web, the cylinder machine requires no modification, but it is necessary to employ a multiple Fourdrinier.

Other methods and apparatus may be employed to fabricate or felt the webs, but I prefer paper making practice because the web obtained has the desired structure, that is (1) the fibres and cork are interlaced and intimately associated in what is best described as a hinging or pivoting of the fibres on the cork particles, thereby forming a strong and resilient web characterized by numerous voids and interstices, (2) it is cellular and capable of exerting capillary effect, (3) the web can be treated uniformly throughout its interstitial mass to improve the inherent characteristics and render it flexible and resistant to bending strains, and (4) the stratified web may have its respective layers simultaneously produced and bonded together by felting.

Where a web of fibres and cork is to be produced, the stock is felted, squeezed and dried in the usual manner. It may or may not be calendered as desired. The thickness of the web may be regulated on the machine in accordance with the product desired.

In the case of the stratified web and referring by way of example, to the drawing, the cylinder vats 10 contain a stock composed of a mixture of cork and fibres while the end vats contain stock which is exclusively fibres, preferably one or a mixture selected from the above group. Thus, there will be built up, i. e. simultaneously formed and bonded by felting, a substantially integral structure having a layer or core of the mixture and facings exclusively of fibre.

This arrangement of the vats may be reversed to produce a web having facing layers of the mixture, or they may be positioned alternately. Likewise, the number of vats may be decreased to form a single facing layer or increased to produce a greater multiple of laminations.

The thickness of the respective layers may be regulated on the paper-making machine in accordance with the product desired by varying the number of cylinders employed, by varying the machine speed or the type of felt

employed, and by changing other control factors which are well known in the paper-making art.

Preferably, the layer composed exclusively of fibres will be relatively thin with respect to the cork and fibre layer. However, the layers may be of any desired thickness, equal to each other, or the fibre layer of greater thickness than the cork and fibre layer.

The final webs obtained, that is the single ply web or the composite web, will have the characteristics above enumerated, but will tend to crack or exhibit weakened areas if sharply flexed or creased. In other words, this product will have a tendency toward brittleness and will not possess a flexibility comparable to the saturated material.

In order to obtain the products of my aforesaid applications, I permeate the web by permanently and insolubly incorporating therein a flexible binder. This binder will be selected in accordance with the intended purpose of the material, that is for gaskets, floor coverings, artificial leather or other products and according to the particular coating which is to be subsequently applied.

The binder creates a stronger union between the fibres and cork particles, increases the strength and resilience of the respective webs and has the particular function or capacity of overcoming any tendency of the web to crack or weaken under creasing or folding strains. Also, according to the specific requirements of the resultant saturated product, a binder can be selected which will render the product oil-proof or water-proof or both.

The binder will uniformly coat the cork particles and impregnate the fibres throughout the cellular structure of the web and will be present in sufficient amount to permanently insure and preserve a maximum of strength, resilience and flexibility in the web.

By "flexible binder", I mean a binder and a plasticizer, or a binder which has both an adhesive function and the function of a plasticizer.

Examples are glutinous adhesives, such as casein, hide, bone, albuminous and similar glues capable of being rendered insoluble, and which can be treated or tanned, so as to become permanently and insolubly incorporated in the structure of the sheet.

As tanning agents, I resort to one or more of such materials as formaldehyde, paraformaldehyde, hexamethylenetetramine and sodium bichromate. In connection with the glutinous binder and tanning agent, I utilize plasticizers of which glycerine, sulphonated castor oil, diethylene glycol, and aquaresin are examples. Thus, I employ a plasticized adhesive or binder, and I find that with such a saturant the single ply or laminated structures are strengthened so as to be resistant to tearing, are rendered flexible, in that they

will not crack under sharp creasing or folding and are pliable, in that regardless of the degree of flexing, to which they are subjected, they will return to the normal sheet-like condition without noticeable creases or any indication of the lines of bending. Moreover, such saturant being permanently and insolubly incorporated throughout the cellular structure of the webs not only lends a resilience or pliability to the sheet, but enhances, to a remarkable degree, the inherent compressibility and rebound.

Further examples of satisfactory flexible binders are natural or synthetic resins of which innumerable varieties are commercially available and which may be treated by conventional processes and with modifying agents as understood in the art, to impart the necessary flexibility and elastic characteristics.

Of the natural resins, I resort to Kaorui and Copal resins, degelled linseed and China-wood oils, as well as modified China-wood oil, and of the synthetic resins, I find those of the alkyd, furfural and phenol-formaldehyde type, such as bakelite, are very acceptable, as well as polymerized isoprene and chlorinated rubber. For certain uses, a satisfactory product can be obtained by impregnation with cheap material such as bituminous matter or pitches, that is bitumens which may be secured from the natural pitch lakes or as by-products from coke ovens.

These resinous plasticized binders afford the same results obtained with those of the first class above mentioned, in that the sheet is strengthened, its tendency to crack or weaken replaced by a flexibility resistant to sharp creasing and folding, and the compressibility and rebound not only is not disturbed, but is made effective to a greater degree.

In addition to the plasticized adhesives which have been recited, I have also employed rubber in the form of latex, and I prefer to use a vulcanized latex or a mixture of rubber latex and an agent, such as sodium polysulfide. In order to prolong the useful life of the product, an antioxidant, such as phenol-alpha-naphthylamine and phenyl-beta-naphthylamine, may form a part of the latex treatment, and, in some cases, I have used a suitable vulcanizing agent with or without an accelerator.

Of the flexible plasticized adhesives above mentioned, it will be observed that many of them, such as the glutinous and resin binders are not only resistant to moisture, but are, moreover, inert with respect to various organic and inorganic solvents, of which mineral oils and distillates are examples.

In selecting the various saturants or binders, the particular use of the material is the determining factor. In gasket materials it is essential that the article resist the action of

water and oil so that it will not disintegrate when used to seal joints in pipes or containers conveying these fluids. In the manufacture of artificial leather, as well as floor coverings comparable with linoleum and artificial linoleum, it is essential, in most cases, that the article be moisture resistant.

The finished web when permeated with rubber latex or natural and synthetic resins, for example, will produce flexible floor coverings and artificial leather not affected by water.

In the manufacture of gasket material the tanned plasticized glue is very acceptable, and the product, while hygroscopic, will not disintegrate in water, and is very resistant to mineral oils and distillates.

The incorporation of the binder in the webs may be accomplished in a number of ways.

I prefer a method wherein the web is passed through or immersed in a bath. In this method, the web is continuously passed to the bath from the paper making machine or from rolls upon which it has been wound after leaving the machine.

The drawing illustrates, by way of example, a tank containing glue and glycerine in the proportions of one part of glue, three and one-half parts of glycerine and seven and one-half parts of water. In practicing the process for the production of the material for uses in many fields, I prefer to employ a bath or saturant containing a hygroscopic agent, such as glycerine, since for many uses the material is preferably one which is continuously moist and has a substantially greater degree of moisture than it would in the absence of such an agent. The web is led through this bath, thereafter through a cooling zone to jell the glue without freezing it, and then through a tank containing a solution of one part glycerine, one part formaldehyde and six parts water. The respective proportions indicated may be departed from as desired and are simply given by way of illustration.

The web so treated is dried in any suitable manner, as on the drying rack shown, and it is noted that this festooning does not produce cracks or lines of fold in the web, indicating the remarkable flexibility and strength of the web. The web is thereupon wound up into commercially distributable rolls.

The web treated by immersion, as just described, has permanently and insolubly incorporated throughout its cellular structure, the flexible binder. This complete saturation is attained by reason of the interstitial nature of the web. That is to say, the presence of the separator, i. e. the cork particles, and their interlaced relation with the fibres, produces cells, air spaces and voids, whereby the web exerts a maximum capillary effect and the fibres are impregnated and the

cork particles coated. In fact, both the fibres and cork are encased in the binder, and the thorough permeation of the web assures the presence uniformly throughout the web
5 structure of sufficient binder to obtain and preserve, the qualities of strength, resilience and flexibility.

In the case of the stratified web having a layer or layers exclusively of fibres, this
10 thorough and uniform permeation is obtained, since such layers are porous permitting capillary action and the fibres are absorbent and capable of impregnation.

Any of the above mentioned binders may
15 be used, as determined by the product desired, and prepared as a bath with their modifying agents, through which the sheet is passed.

In this connection, a single bath may be
20 employed or several independent immersions resorted to. Thus, I may incorporate the glue, glycerine and paraformaldehyde in a single bath, with a suitable retardant, i. e. oxalic acid to delay the glue-formaldehyde
25 reaction.

Further, the resinous and latex binders are capable of being cured in the sheet by means of heat and pressure or heat alone without producing any deleterious results. This is
30 particularly true with bakelite resins as well as the rubber saturants.

As a further modification of the process, I may incorporate the binder with components of the cork fibre mass before this pulp mass
35 is passed to the beater. This practice is called premixing and I may premix the binder with the fibre alone or with the cork particles alone or with both the cork and fibre before submission to the beater. This
40 treatment is most practical and adapts itself most readily to the use of resinous binders such as bakelite, for example.

Again, the respective binders and their modifying agents may be added in the beater.

45 As a further alternative method of impregnation, the completed web may be subsequently saturated in a bath, which method has been described and illustrated.

I may also add one or more of the components of the binder to the cork and/or
50 fibres before mixing or to the beater mass, and the further treatments may take place during the formation of or after the web is formed. In other words, I may resort to the
55 single use of premixing, beater addition, or subsequent bath saturation in order to impregnate the web with the binder, or I may utilize a combination of any two or three of the above processes. As an illustration, I
60 may add a binder by premixing and add more of the same binder or another or a modifying agent in the beater or by subsequent immersion in a bath. In other words,
65 independent consecutive treatments with the components of the saturant may be resorted

to according to the binder employed and the specific qualities required in the resultant product.

As types of impregnating resinous materials, I may use the flexible alkyd resins or
70 bakelite types (that is, phenol-formaldehyde types) or other kinds of suitable resins available in the trade. It will usually be found advantageous to use both heat and the
75 commonly indicated solvents for the type of resin employed in order to secure the proper degree of fluidity for ready saturation in case the bath method is employed. The exact procedure will depend upon the method of
80 impregnation and the properties of the resin used. In some cases, the resin will be substantially pure but in other cases modifying agents such as polymerized linseed oil or
85 China-wood oil may be present or suitable drying oils alone such as polymerized China-wood oil may be used as saturants. Subsequent curing of the permeating oils and
90 resins will depend upon the nature of the specific saturant or saturants used and the properties of the product desired. Thus the permeated web may be subjected to both heat
95 and pressure to cure the impregnating medium or to heat alone or to heat and oxygen (air) according to whether the permeating medium is heat reactive, oxygen reactive or
100 both heat and oxygen reactive. Some saturants such as air drying varnishes or resins may be air cured at ordinary temperatures, but in general, higher temperatures with
105 shorter curing times will be preferable. As illustrations of the above types, I prefer bakelite which is most advantageously cured with heat and under pressure, but which may
110 be cured by heat alone; the modified alkyd resins as for example, the alkyd resins combined with China-wood oil and suitable
115 driers which are readily cured by heat and oxygen (air) and the so-called air drying varnishes with either natural or synthetic resins, which may be air-dried at ordinary
120 temperatures.

Where rubber is used as the permeating medium, I may employ vulcanized latex or vulcanized rubber which has been re-dispersed
125 or vulcanized rubber dissolved in a suitable organic solvent. If a bath saturation process is used, the web can be saturated with rubber latex to which has been added sodium polysulphide or colloidal sulfur and a suitable
130 antioxidant and the web subsequently dried at about 135° F. An alternative method is to saturate with a rubber latex which has been mixed with a low temperature accelerator such as piperidine penta methylene dicarbonate and an antioxidant such as Neozone L
135 (Dupont Co.) and dry at about 135° F. and then vulcanize at about 200° F.

The exact procedure or process as far as the addition of the impregnating medium is concerned as well as the impregnating mate-
140

rial used, will vary according to the requirements of the resultant product and the use for which the finished material is intended.

I also as a modification apply to either of the webs produced in accordance with this invention, a backing of cloth fabric, paper or other preformed material, preferably before finally drying the web, so that the binder may serve to unite the backing. However, the backing may have an adhesive coating or the same may be applied to the finished sheets. Again, the preformed layers may be united to the web immediately after the latter has assumed its form and then the entire laminated structure given a saturating treatment with the flexible binder.

The use of a facing layer formed exclusively of fibres provides a smooth surface which may or may not be calendered according to the requirements as to finish.

The saturated single layer or the laminated product having its layers substantially integral with each other, may have applied to one or both surfaces thereof, any suitable coating, as by spraying, spreading, brushing or immersion.

By reason of the pliability and resilience or plasticity of the web, it forms an excellent base for such plastic and flexible coatings as cellulose lacquers, oleo resin varnishes, of which there are innumerable commercial varieties available. Such lacquers utilize, as a base, a cellulose derivative, such as cellulose nitrate or cellulose acetate, together with a gum and plasticizer, and the present sheet material will cooperate with such a coating to prevent cracking of the coating film. I will also employ China-wood oil varnishes and linseed oil varnishes which likewise are flexible and of which a number of commercial varieties are obtainable.

Furthermore, substantially all of the flexible binders will enable cellulose derivative or varnish coatings and films to be applied to the sheet without difficulty.

In the case of artificial leather, I utilize coatings of pyroxylin, alkyd resins and similar substances which will produce the desired surface, and these, by reason of the flexible and resilient character of my laminated base, will be prevented from cracking or scarring in use.

In the manufacture of floor coverings, such as linoleum and artificial linoleum, I employ the varnishes and lacquers above mentioned, with equal success since the elastic and flexible nature of the coatings will be retained because of the flexibility and resilience of the laminated base.

The present invention is characterized by toughness, i. e., great tensile strength and resistance to tearing. It is further more compressible than the untreated laminated sheet. Moreover, its pliability and flexibility are such that it may be sharply creased or folded

without fear of producing permanent cracks and lines of fold. Again by the proper selection of the binder or impregnating medium, the product may also be rendered oil-proof and waterproof.

It will be understood that the facing layer 11 forms a smooth surface which may be readily coated, and that if desired, this layer may be subjected to a calendering to obtain a very high finish.

In referring to "stock" in the appended claims, I mean the mixture of cork and fibres, or the mixture of cork, fibres and binder prior to formation of the web.

I claim:

1. The process of making a paper-like material which comprises preparing a mixture of comminuted cork and fibres with sufficient water to form a stock, forming the stock into a web, and including a flexible binder in the web and in amount sufficient to increase the inherent strength and resilience of the web and render it flexible so that it is resistant to creasing and flexing.

2. The process of making a paper-like material which comprises preparing a mixture of comminuted cork and fibres with sufficient water to form a stock, preparing a stock composed exclusively of fibres, forming the respective stock masses into webs and bonding them together to form a substantially integral web, and including a flexible binder uniformly throughout the individual webs of the composite web and in amount sufficient to increase the inherent strength and resilience of the web and render it flexible so that it is resistant to creasing and flexing.

3. The process of making a paper-like material which comprises preparing a mixture of comminuted cork of effective size and fibres with sufficient water to form a stock, forming the stock into a web having multitudinous air cells, voids and air spaces, capable of exerting capillary action and in which the cork and fibres are in interlaced relation, and including a flexible binder in the cellular structure of the web to impregnate the fibres and coat the cork particles so that the binder is present in amount sufficient to increase the inherent strength and resilience of the web and render it flexible so as to be resistant to creasing and flexing.

4. The process of making a paper-like material which comprises preparing a mixture of comminuted cork and fibres with sufficient water to form a stock, forming the stock into a web of cellular structure capable of exerting capillary action and in which the cork and fibres are in interlaced relation, and thereafter passing the web through a bath containing a flexible binder to incorporate the same in the cellular structure of the web to impregnate the fibres and coat the particles so that the binder is present in amount sufficient to increase the inherent strength and

resilience of the web and render it flexible so as to be resistant to creasing and flexing.

5 5. The process of making a paper-like material which comprises preparing a mixture of comminuted cork and fibres with sufficient water to form a stock, preparing a stock exclusively of fibres, forming the respective stock masses into webs of cellular structure capable of exerting capillary action, uniting
10 the webs by felting to form a substantially integral web, and thereafter passing the web through a bath containing a flexible binder to incorporate the same in the cellular structure of the composite web to impregnate the fibres
15 and coat the particles so that the binder is present in amount sufficient to increase the inherent strength and resilience of the web and render it flexible so as to be resistant to creasing and flexing.

20 6. The process of making a paper-like material which comprises preparing a mixture of comminuted cork and fibres with sufficient water to form a stock, preparing a stock composed exclusively of fibres, forming the respective stock masses into a substantially integral web and including a flexible tanned
25 glutinous adhesive binder in the composite web in an amount sufficient to increase the inherent strength and resilience of the web and render it flexible so that it is resistant to creasing and flexing.

30 7. The process of making a paper-like material which comprises preparing a mixture of comminuted cork and fibres with sufficient
35 water to form a stock, forming the stock into a web of cellular structure capable of exerting capillary action and in which the cork and fibres are in interlaced relation, and thereafter immersing the web in a flexible glutinous adhesive and a tanning agent to incorporate the same in the cellular structure of
40 the web to impregnate the fibres and coat the particles so that the binder is present in amount sufficient to increase the inherent
45 strength and resilience of the web and render it flexible so as to be resistant to creasing and flexing.

In testimony whereof I affix my signature.

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ELMER C. SCHACHT.

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