Alvin W. Boese Papers.

Lens Tissue:

77655

5/4/44 Lens tissues

Aralac fillers - # 77653D lots

Lot 1 - 70 parts 3 denier 1¼" plast. Eastman Acetate
30 parts 15 micron 1½" HRHG Aralac

Lot 2 - 70 parts 3 denier 1¼" plast. Eastman Acetate
30 parts 15 micron 1½" regular Aralac

These were carded and pressed by June Bracken. Pressing temperature was 300°F for each lot, which is very low. Further, examination of the paper web showed that the fibers had flowed very little and were not distorted as is the case with acetate - viscose. Where two fibers joined there was not bamboo-like joint, but apparently only a simple crossing. In spite of this the paper was quite well bonded. When the Aralac fibers were pressed alone, no bonding occurred. Mixed with unplasticized acetate - no bonding at 450°F. Hence, here is a peculiar effect which serves to lower bonding temperature.

The question of sizing viscose fiber with casein ~~will~~ to secure better bonding at low temperature will be investigated. A 1-5% soln of casein will be used to size viscose fibers.

The casein solution (1%) caused the viscose tow to stick together. A better method for treating must be devised.

E. F. Michel

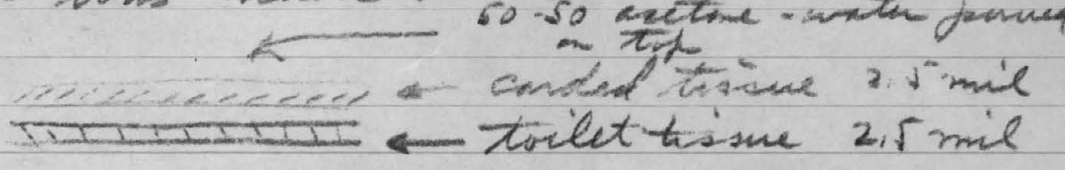
77653D Lot 1

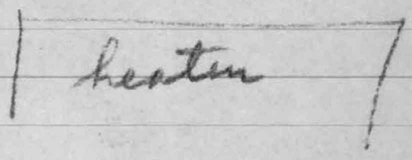
77653D lot 1

~~77678~~
77679.

11/25/44 Lens Tissue

To improve absorbency of carded tissue for lens cleaning purposes a combination of ~~carded~~ tissue with absorbent paper was made:





sandwich rolled down on hot plate at 380°F.

Good bond obtained at places where solvent + heat were in right degree. Absorbency very noticeably improved. Some increase in lint seems to have been occasioned. Sample #77678 is attached. If possible a less linty absorbent tissue will be obtained for use.

G. D. Miehl 11/25/44

77652

4/4/44 Subject: Lens tissues

A program on lens tissues was begun. This will involve testing of competitors' papers for comparison with ours, and also formulation of different types in the laboratory.

Lens tissues, competitors - Aldine
Mac Adam
Brown & Dey
Kleenex
Japanese tissue - if obtainable
Ross
Webril - Kendall
Fran Allen Hunter
Eastman
5½" Troya
5½" Dexter

Formulation will involve:
1. Plasticized fibers: 3 denier Eastman
3 denier Celanese
1.5 denier home plasticized.
2. Filler fibers: Viscose - various deniers, also pigmented.
Cuprammonium - if obtainable.
Aralac - if obtainable.
Cotton - long staple, bleached
3. Processing - drum pressed paper
calender pressed paper
Garnett - drum pressed paper.

Methods of testing will be devised for tensile, etc., + other physical tests, polishing ability, lintiness, wet + strength, life, abrasion (on glass + lucite, + with abrasive particles.

E. F. Mickl 4/8/44

77653

4/6/44 Lens tissues

\# 1. Lots of 1.25 denier, 1 7/8" Viscose and 3.0 denier, 1 1/4" plasticized acetate.
Acetate varied from 60 to 80 parts
5 parts of dyed tracer (viscose) used.

#77653 lots	1	2	3	4	5
Acetate	60	65	70	75	80
Viscose	40	35	30	25	20

See June Bracken's notebook - pp. 83615-83617.

2. #77653A lots. Various viscose tissues

77653A lots	1	2	3	4	5
70 parts 1 1/4" plast Eastman 3.0 d. acetate					
30 parts Viscose	1.0 denier 1 9/16"	1.25d. 1 7/8"	1.5d 1 9/16"	3.0d 1 9/16"	5.5d 1 9/16"

Papers made April 10 + 11, 1944. See June Bracken's notebook - page 83619.

3. # 77653B lots - Cotton lots.

#77653B lots	2	1
3.0d 1 1/4" plasticized Eastman acetate	70	30
446 Bleached garnetted Riverside Mills Cotton	30	70

See June Bracken's notebook 83620

4. #77653 C lots - Higher Viscose content
All 77648 lots.

77653C lot	1	2
3.0 d. 1 1/4" plast. Eastman acetate	30	40
1.25d 1 7/8" Avisco	70	60

See June Bracken's notebook 83620

E. F. Mickel

83615

"Lens Tissue"
1-5-44 #77653

The following lots were made and made into lens tissue.

LOT-1

3 den. - 1¼" — 60 grs.
plast. cell. acetate
Eastman

1.25 den. 1¼" — 35 grs.
viscose
colored viscose (red) — 5 grs.
} 40

LOT-2

3 den. 1¼"
plast. cell. acetate — 65 grs.
Eastman

1.25 den. 1¼"
viscose — 30 grs.
colored viscose (black) — 5 grs
} 35

LOT-3-T

3 den. 1¼"
plast cell acetate — 90 grs.
Eastman

1.25 den. 1⅛"
viscose — 25
colored viscose (red) - 5
} 30

Cont.

83615

Cont. 4-5-44

LOT-4 LOT # 77453

3 den. 1¼"
plast. cell. acetate — 75 grs.
Eastman

1.25 den 1⅞" — 20 grs
viscose } 25

colored viscose (black) - 5

LOT-5

3 den. 1¼
plast. cell. acetate - 80 grs.
Eastman

1.25 den. 1⅞" — 15 grs.
viscose } 20

Colored viscose (red) - 5 grs

LOT - 3C

celanese — 70 grs.

1.25 den. 1⅞" — 25 grs.
viscose } 30

colored viscose (red) - 5 grs.

Carded colored viscose separately first to separate better and also the celanese in lot-3C.

Cont.

8361 T

cont. 4-5-44

LOT # 77053

LOTS -	1	2	[illegible]	[illegible]	[illegible]	3-C
Feed	17	17	17	17	17	17
open	8"	8"	8"	8"	8"	8"
Carding	stripping	slightly stripped	slightly stripped	3/4 stripping	practically strip	slightly stripp
Formation	good	very good	very good	good	very good	good
Distribution	streaky	streaky	spotty & streaky	Streaky	streaky	spotty & streaky chips-
Roll temp.						
	T - B	T - B	T - B	T - B	T - B	T - B
start -	350° - 375°	370° - 375°	325° - 335°	330° - 330°	325° - 340°	380° - 390°
middle -	350° - 355°	370° - 350°	325° - 325°	330° - 340°	330° - 315°	400° - 400°
end -	355° - 350°	345° - 350°	340° - 340°	320° - 330°	no get	380° - 400°
Room temp.	80°	82°	80°	82°	80°	80°
Humidity	50°	51°	50°	51°	50°	50°

Subject: Manufacture of lens tissue. CF#8

Object: To determine best feed weight for 75-25 mixture of 3-denier acetate and 1.25 denier viscose.

Lot	Feed wt	Appearance
1	15	Nice formation, but open
2	16	" " denser than 1
3	17	Excellent " " " 2
4	18	Formation not as good as 3
5	19	" " " " " 4
6	20	" " " " " 5
7	21	
CF#9 lot 1	22	(Made 10-27-43) Nice carding, but fancy filled up.

Fancy filled on all lots after lot 4.

Conclusion: best feed weight is 17 or 18 gr. 17 gr gave a better formation than 18 gr.

E. F. Michl
11-22-43

732 39

Paper making
Project No 197

November 22-43

Lens Tissue

Material Used:

Lot 1.

			Staple
75	grams	3 den Cell Acetate plastisized.	1¼"
20	"	1.5" Viscose	1½"
5	"	4.5" "	1 9/16"

Lot 2.

75 grams 3 den Cell Acetate plastisized
20 " 1.25" Viscose
5 " Bleached Strip Cotton.

Method Used:

Fibers Carefully Sandwiched together + hand picked. Carded three times - web being formed at third carding. Carding done in Carfab lab on our small carder.

Reason for these lots

To Prove ~~it~~ our paper could be used for, or in Woolonsak's cleaning operation. These lots were to make stronger sheets than lens tissue previously made. Scotty Brady's report was - our paper tore too readily.

Results

At third carding web was passed thru heated callender rolls, built by J. Pearson. Temp of rolls as follows: Top

Lot 1 - Bottom - 380° f
middle 380° f.

Lot 2. Bottom 375° f
middle 350° f

Barometric Pressure - Reading - 29.2
Temp 70
R.H. - Low - very much static

Lena Hentz

732-38

Paper Making
project #197

October 25, 1943

Lens tissue

Material Used:

900 grams 3 denier cellulose acetate plasticized fibers 1¼" staple
300 grams 1.25 Viscose fibers 1½" staple

Method Used:

Fibers carefully sandwiched together. Carded twice, web being formed at 3rd carding.
The carding was done in the lab on our small carder
The humidity very low, and temp of room 82°f Static bothered very bad; made carding very difficult.

Results:

The third carding took place October 27. 1943. At this last carding the web was passed thru hot calendar rolls heated to between 375 + 400°f. Web made by Ed. + Vic.
Barometric Reading 29.4

Lena Wentz

732 37

Paper Making
Project #197

October 13, 1943

Lens Tissue

Lot 2.

Material Used:

200 grams 3 denier 1 1/4" Staple plasticised Cellulose Acetite fiber

Lot 3. 150 grams 3 denier 1/4" staple plast. Cellulose Acetite fibers
50 grams 1 " 1 1/2" "

Method used:

Each lot individually carded three times - Web being formed at 3rd carding

Results:

Lot 2 - no web was formed, for static conditions bad. web uneven and thin.

Lot 3. 24 gram feed wts used. made a very thin web. temperatures were kept between 315 and 320°f on the calendar rolls thru which the web was passed

Barometer Reading - 29
R.H. 55
Room temp. 70

Vic Potter took the web to the Slitters.
Was to be slit 6" wide in 5 yd. lengths, on one inch cores. Was mailed to A.W. Boese at New York, Oct 14, 1943, by Air Mail.

Lena Wentz

73236

October 12 1943

paper Making
Project #197

Lens tissue for field evaluation:

Lot 1.

Material Used:

1400 grams 3 denier 1¼" Staple Plasticized fibers
600 grams 1.25 denier 1½" Staple Viscose fibers
18 gram feed wts used.

Method Used:

Material sandwiched together and carded three times, - web being formed at third carding
All the material was run at one time, one hr steady run.

Temperature Used:

Web was passed thru hot calender rolls at a temperature of between 375° f and 400°f.

A uniform web was the result. Vic Potter had this material slit and Put on 1" Cores 6" wide containing 25 yds each. They were sent to New York to the attn. of Boese by air Oct. 13, 1943
Produced 23 rolls - 25 yds each x 6" wide. Time of run 1 hr. 10 min.

Barometric Reading 28.8 Rising
R. H. 48.

Lena Hentz.

Were

Paper Making
Project #199

732 35
Oct 8, 1943

Lens Tissue
for field evaluation

Lot 1.

Material used:

700 grams 3 denier 1¼" staple plast Cellulose acetate fibers

300 grams 1.25 denier 1½" Staple Viscose fibers

Method used:

Material was picked and mixed together then carded three times web being formed at 3rd carding, 18 gram feed weights used

Temperature used:

All thru run temperature stayed from 350° to 400°
Web was pressed thru hot Calender rolls at above temp.

Time:

1000 grams were run in 29 minutes without a stop.
Barometric reading 29.1
Relative Humidity 34
Samples are being kept - test will be made
namely RR#1 Lot#1.

Lena Wentz

Patents

Lens Tissue

83611

Lens Tissue R.R.#
1-26-44

The following lots of lens tissue was made: 1000 grs of each were made

RR #3 LOT I - (75-25)
750 grs. - 3 denier plasticizer aceta
250 grs. - 1.25 denier 1⅛" viscose

R.R. #4 LOT II - (70-30)
700 grs. 3 denier plasticizer aceta
300 grs. 1.25 denier 1⅛" viscose

Procedure:

1- Weighed out each type of fiber separately.
2- Picked apart by hand and spread
3- Mixed thoroughly.
4- Carded first time with thin feed - (II loss - 8 grs) about 16 grs. If fancy filled, feed (I loss - 82 grs) was too high.
5- Carded second time with 16 grs. feed weight. Determined total weight to get loss of first carding
6. Weighed out 16 grs. feed for third carding. Paper was made on this carding. Determined total weight to get loss of second carding.

June Bracken
1-26-44

Lens Tissue

4-7-44

The following lens tissue was prepared using this formula:
75 parts - 3 den. 1 1/4" plastized acetate
25 parts - colored Viscose fibers -(red)

This amount of fibers were divided into ~~five~~ lots, 1,2,3,4,

	Feed	
LOT-1 -	14 grs.	2 feeds each.
LOT-2 -	15 grs.	" "
LOT-3 -	16 grs.	" "
LOT-4 -	17 grs.	" "

The temperature was kept at 375° F. and the total amounted to 150 grs.

Jane Bracher
4-7-44.

83619

"Lens Tissue" #17653-A

4-10-44

The following lots were prepared, carded, and pressed.

Lot-1 - 70 parts - Acetate
30 parts - Viscose - 1.0 den 1 9/16"

Lot-2 - 70 parts - Acetate
30 parts - Viscose 1.25 den. 1 9/16"

Lot-3 - 70 parts - Acetate
30 parts - Viscose 1.5 den 1 9/16"

Lot-4 - 70 parts - Acetate
30 parts - Viscose 3.0 den 1 9/16"

Lot-5 - 70 parts - Acetate
30 parts - Viscose 5.5 den 1 9/16"

Temp. - approximately 275°

June Bracken
4-11-44

83620

"Lens Tissue" (1-2 ~~#77653-A~~)
4-11-44 (1-2 #77653-B)

The following lots were prepared and pressed on the calender.

LOT - 1
70 parts - 1.25 den. 1 7/8" Viscose
30 parts - 3. den 1¼" Acetate 1¼

LOT - 2
60 parts - 1.25 den. 1 7/8" Viscose
40 parts - 3. den 1¼" Acetate
#77653B - 1,2

LOT - 3
70 parts - Bleached garnett #446
30 parts - 3 den. 1¼" Acetate

LOT - 4
70 parts - 3 den. 1¼ Acetate
30 parts - Bleached garnett #446

LOTS - 1, 2 - temp. 350° to 375°

LOTS - 3, 4, - Temp. 375° to 425°

June Bracken
4-12-44

83621.

Lens Tissue

4-12-44

The following lots were prepared for general use.

LOTS-1-2

70 parts - 3 den. Acetate
30 parts - 1.25 Viscose

LOT-3

70 parts - 3 den. Acetate
30 parts - 1.0 den Viscose

LOT-4

70 parts - 3. den. Acetate
30 parts - 1.5 den. Viscose

Lots 1 + 2 were calendared at a temperature ranging from 350° to 375°. Lots 3 + 4 at a temp. ranging about 300° to 350°

June Brasher
4-13-44

Lens tissue patent 11-2-43 IIA5

This patent relates to a ~~thin~~ lens cleaning tissue paper made from textile length thermoplastic synthetic fibers

There are many light weight tissues on the market for lens cleaning. Most of them are made from long fibered rope papers.

Lens Cleaning Tissue   11-5-43   IIA5

Paper Lens tissue	Cloth:	Reed material
Our product has the following qualities not possessed by standard tissues		
Lint free	Lint free	
Wet strength	cost	
no fiber webs	No webs.	
better cleaning action?		

electrostatic properties of our web?

a test to take in the field to show lint free character
A small black glass plate, and an abrasion to fit on finger or something similar which can be used by salesmen

~~1.84~~

270

3/22/43

Lens Tissue — Plattsburg

Patent data

Capable of removing a variety of foreign films leaving clear surface

should not disintegrate readily

lens polish. (Non linting
Polishing

soft.

absorption when used wet.

~~tests. physical test shows non linting~~

non abrasive

should be able to have good enough surface absorp. to use ~~[illegible]~~ several times

sufficiently open mesh structure to pick up any abrasive particle that may be present with leaving it on the surface

The paper should be soft enough to use with new synthetic lens

Wet strength

economy over cloth — also polishing action — softness

distinction diff. from cloth more area per weight.

AW Breese

Refer to letter to Elaine A. Lapointe of December 6, '43 from B W Scribner of U. S. Dept of Standards [illegible] competitive products - less tissue

Patented July 27, 1943 **2,325,302**

UNITED STATES PATENT OFFICE

2,325,302

HIGH-WET-STRENGTH PAPER

Kenneth W. Britt, Norwood, Pa., assignor to Scott Paper Company, Chester, Pa., a corporation of Pennsylvania

No Drawing. Application November 3, 1938, Serial No. 238,693

8 Claims. (Cl. 117—155)

This invention relates to the art of paper making, and a principal object of the invention is to provide papers having a relatively high degree of wet-strength. This application is a continuation-in-part of my application Serial No. 91,963, filed July 22, 1936.

Another object of the invention is to provide paper whose wet-strength is materially increased without unduly modifying the normal desirable characteristics of the paper or such properties as water absorbency and softness required in certain classes of paper.

Another and more specific object of the invention is to provide soft, absorbent papers, such as those employed for towels and toilet tissues, that possess a relatively high degree of strength and resistance to surface disintegration while in the wet state.

In the normal paper making process cellulosic fibres, i. e., fibres derived from various plant materials and consisting essentially but not entirely of cellulose, are deposited from suspension in water to produce an interfelted web. A considerable amount of adhesion or bonding between the individual fibres in contact with each other develops upon drying this web, and it is this peculiar property of cellulose that accounts for the strength of normal papers.

It is thought that at the point of contact between two fibres in a dry sheet of paper there is a minute portion of the cellulose structure which may be considered to be held by the two fibres in common. In the normal paper this cellulose structure is hydrophilic, not in the sense of any of the material actually being soluble in water but in the sense of being capable of associating itself intimately with water and thus having its cohesive strength substantially reduced, so that the bonding, cementation, or adhesion between the cellulose fibres of conventional papers has had the disadvantage of losing its strength when wetted with water. Thus, most papers when wet have only a relatively small per cent., say 5 to 10%, of the strength that they possess when dry.

The present invention provides a means for modifying the cellulose structure constituting the bonding or cementation between the individual fibres so that it shall remain strong when the paper is wetted.

In carrying out the invention, the dry or partially dry web of paper is impregnated with a water solution containing a substance or substances capable under the proper heat and catalytic conditions of polymerizing to a water-insoluble condition. In order that the wet-strengthening agent may actually penetrate the cellulosic structure of the individual fibres, it is important that it exist initially as a true solution in water. After the penetration into the fibres the agent must be capable of polymerizing rapidly to the insoluble state under relatively mild conditions of heat, e. g., under the conditions of normal drying of paper on a paper machine or paper treating machine. Materials fulfilling the above requirements are found among the substances capable of forming synthetic resins.

In proceeding in accordance with the invention, therefore, there are introduced into the cellulose structure resin-producing ingredients either in the unreacted, the unpolymerized, or the partially reacted state, and thereafter the reaction or a completion of the reaction between these ingredients is effected to produce the desired result. The materials from which the final resin is formed should enter the cellulose structure in the form of a water solution, and for this condition to be fulfilled, the materials should be in the form of compounds of relatively low molecular weight and soluble in water. These materials having penetrated the cellulose structure are caused to undergo a condensation or polymerization, or both, as a result of the application of heat in the presence of a catalyst, and this reaction results in the formation within the cellulose structure of a water insoluble resin, the presence of which, particularly in that part of the cellulose structure where two fibres have been dried in contact with each other, has the result of rendering the cellulose bond substantially unaffected by water. Where the properties of absorbency and softness are required, it is essential that no large proportion of the resin shall exist between the fibres of the paper outside of the cellulose bonding structure, since excess resin has the effect of increasing the stiffness of the sheet.

Several materials may be used in this process, such, for example, as urea and formaldehyde, urea and hexamethylenetetramine, thiourea and formaldehyde, urea and acetaldehyde, and urea and butyraldehyde, the said aldehydes being saturated aliphatic aldehydes having from 1 to 4 carbon atoms. In addition, numerous other materials are potentially capable of affording the desired results, such, for example, as urea and furfural, phenol and formaldehyde, phenol and furfural, phenol and butyraldehyde, phenol and acetaldehyde, phenol and hexamethylenetetramine, and phthalic anhydride and glycerol. In general, the materials which are potential agents for accomplishing the purpose of this invention may be defined in the following terms:

1. They should be soluble in water;
2. They should exist in the cellulose impregnation stage in the form of sufficiently small molecules to permit their ready penetration into the cellulose structure; and
3. They should be capable after penetration into the cellulosic structure of undergoing a reaction resulting in the formation of a water insoluble, resin-like material.

I am aware that the impregnation of cellulosic materials with solutions more or less similar to the above has been the subject of previous inventions. For example, urea and formaldehyde has been suggested for rendering regenerated cellulose (rayon) fabrics resistant to creasing. These processes, however, involve the use of such quantities of urea-formaldehyde that when applied to paper of the sort contemplated by this invention they destroy the essential physical properties of the paper. Further, a study of the effect of urea-formaldehyde on rayon fabrics would not suggest the very different function disclosed by this invention. Also, it has been suggested to use urea-formaldehyde to prevent the "swelling" of cellulosic materials. Here again the application of the previous invention in such a manner as to substantially reduce swelling destroys certain physical properties of paper which it is the purpose of this invention to preserve. Further, the use of urea-formadehyde as specified in this invention has no appreciable effect on the swelling characteristics of the material.

It is an essential feature of this invention that the polymerization or insolubilizing reaction take place quickly and easily in order to permit the incorporation of the process as a step in the manufacture of paper. 'In order to realize this the polymerization reaction must be accelerated by the use of a catalyst. With urea-formaldehyde, phenol-formaldehyde, and thiourea-formaldehyde the most suitable catalyst is an acid or acid salt. I may, for example, use a mineral acid such as sulphuric acid, hydrochloric acid, or phosphoric acid, or I may use an organic acid such as acetic acid or formic acid, or I may use an acid salt such as ammonium chloride, sodium bisulphate, aluminum sulphate, or zinc chloride; or I may use a neutral salt which becomes acid under the heat conditions incidental to drying the impregnated sheet, for example, secondary ammonium phosphate, or ammonium sulphite.

With the use of urea-formaldehyde, for example, it is not difficult to select a catalyst which will induce a rapid polymerization under the heat conditions incidental to the drying of paper since any material capable of producing a mild acid condition will serve. It is, however, more difficult to select a catalyst which will give a relatively stable stock solution when mixed with urea-formaldehyde, and which need not be removed from the finished sheet. Secondary ammonium phosphate has been found to fulfill these conditions most satisfactorily.

Of the various combinations of materials mentioned above, urea and formaldehyde are particularly well suited for the practice of the invention in that, in an intermediate or partially reacted stage these materials are productive of a water-soluble solid. Depending upon the proportions of formaldehyde and urea, this water-soluble solid takes the form either of monomethylolurea or dimethylolurea, or a mixture of the two. Dimethylolurea has been found best suited to the requirements of the present invention, although it is sometimes desirable to employ a mixture of the two ureas.

Dimethylolurea is available in the trade, and its use insures an introduction of the materials in exact proportions and materially facilitates the process as a whole. Further advantages in the use of dimethylolurea reside in the rapidity with which polymerization takes place and in the mild temperature and catalytic conditions necessary; in the absence of any tendency of the polymerized resin to decrease the absorbency of the paper; in the stability of the dimethylolurea solution; in cheapness of raw materials; in the fact that no residual color or odor is left in the treated paper; and in the further fact that there is no decomposition of the resin with age.

In a specific procedure by way of example, paper is impregnated to saturation by any suitable means with a water solution of the following composition:

	Per cent by weight
Dimethylolurea	1.0
Sulphuric acid	0.05

The paper is then dried, preferably at a relatively low temperature, say below 150° F., in order to insure against polymerization while the paper is in the wet or moist state, or until the water phase is reduced to that amount which is contained within the fibres. A considerable degree of wet strength will result regardless of the method of drying, but the maximum of wet strength may only be obtained by initial low temperature evaporation. Subsequent to drying, the paper web is heated to a temperature sufficient to convert the water-soluble compound into a substantially water-insoluble urea-formaldehyde resin, which resin is in a substantially cured condition. The extent of this heating subsequent to drying is not great. It has been found that the amount of heating received by a sheet of paper passing through the drier section of a paper machine in the normal papermaking process is sufficient to cause adequate polymerization.

It is apparent that substantially the same results may be obtained by employing a mixture of urea and formaldehyde rather than dimethylolurea, and in the case of some of the other resin-producing materials, it is necessary to keep the initial solution merely as a mixture in order to retain water solubility. A suitable catalyst may be incorporated in the mixtures in their unreacted state and substantially the same procedure followed as has been described above as to drying the treated sheet and subsequently raising the temperature of the sheet to a point effecting the resin-producing reaction. In such cases, it is desirable to employ the materials in amounts and proportions, readily determinable by those familiar with the art, to afford the desired result without leaving any excess of the materials in the paper sheet, either in the form of the completed resin or in their initial individual forms. The relative proportions of the urea and formaldehyde may be stated, for example, as approximately 1 to 1; and if the materials are added to the paper in amount of about 2% of the weight of the latter, the substantial increase in wet-strength is obtained without appreciable modification in other respects of the normal paper characteristics. It will be apparent that the physical properties of the finished sheet may be varied by using more or less of the resin-forming ingredients.

If dimethylolurea is used it may be prepared by any of the well known methods, but it has been found that the maximum wet-strength is obtained by using the following procedure; urea is dissolved in 37% formaldehyde solution (commercial formalin) in the proportion of 5 parts by weight of urea to 4 parts by weight of HCHO or approximately two mols of HCHO to one mol of urea. Other proportions will produce wet-strength, but it has been found that a higher proportion of urea decreases the amount of wet-strength obtained and a greater proportion of formaldehyde increases the cost and gives residual formaldehyde which must be disposed of. Enough sodium carbonate or other alkali is added to the above solution to give a definitely alkaline reaction. About 0.05% Na_2CO_3 on the basis of urea+formaldehyde is a convenient amount. The solution is allowed to stand from 4 to 12 hours and is then diluted to a suitable concentration with water. After addition of the catalyst, this solution is ready for use in the wet-strength process. The solution so prepared is found superior to a mixture of uncombined urea and formaldehyde and to dimethylolurea prepared by heating.

The acid catalysts which may be employed are such as those already listed above and the amount of these catalysts required is quite small. For example, using sulphuric acid, 0.05% acid in the impregnating solution gives the maximum wet-strength. More than 0.1% sulphuric acid has a destructive action on the fibre. In using aluminum sulphate approximately 0.1% gives the best results, and closely similar amounts are required for the other salts.

It is undesirable to leave unneutralized acidic catalyst in the finished paper, and the paper may, therefore, be treated after the application of the wet-strength process with a suitable alkaline solution. A solution of this character may consist of a mild alkali such as sodium bicarbonate, di-sodium phosphate, sodium borate, or similar salts, in such strength as to neutralize the catalyst and at the same time leave the paper essentially neutral. A solution of 0.3% sodium bicarbonate applied in an amount of 20% of the weight of the dry paper is an effective neutralizer. The paper is again dried after this treatment and the resulting sheet constitutes the finished product.

It is to be remembered that the conversion of dimethylolurea to the insoluble resin takes place slowly in acid solution even at room temperature. For this reason a solution containing any of the above catalysts must be used immediately after the addition of the catalyst, and must be used as a relatively dilute solution. Further, the handling of acidic aqueous solutions presents serious engineering difficulties such as corrosion of machinery and equipment of all sorts. For these and other reasons it has been found more convenient to use as catalysts certain salts which in the initial state are neutral or slightly alkaline but which, upon exposure to the heat incident to drying the impregnated paper, develop a mild acid condition which causes the polymerization to take place. Examples of such salts are tri-ammonium phosphate, $(NH_4)_3PO_4$, secondary ammonium phosphate, $(NH_4)_2HPO_4$, and ammonium sulphite, $(NH_4)_2SO_3$. The first two salts are converted by heat into the acidic mono-ammonium phosphate, while the third is converted to ammonium sulphate. The use of these catalysts has been found to be very convenient in practice. The claims reciting the presence in the paper of "an acid-polymerized resin" include resins polymerized under acid conditions derived either by reason of the presence of an acid or acidic substance at the time of polymerization; thus, the claims include the use of catalysts which may be neutral or slightly alkaline but which upon exposure to heat develop a mild acidic condition which causes polymerization.

As a further practical example of the way in which the invention may be carried into effect employing a catalyst of this type, a sheet of dry paper, for example paper toweling, is sprayed by any convenient means with a solution consisting of the following materials:

	Per cent
Dimethylolurea	3.0
Secondary ammonium phosphate	0.25
Remainder, water.	

The moisture content of the sheet immediately after spraying should be about 25–30%. This would mean the application of about 1.0% urea-formaldehyde resin on the basis of the paper. The paper is then dried on steam-heated rotating cylindrical driers as normally used in the paper industry. It has been found that a drier temperature of 275° to 300° F. and a total time of contact between the paper and the driers of about 30 seconds gives very good results. Paper so treated would normally have a wet-strength of 35–50% of the dry-strength or 4–6 times that of the untreated paper. The dry-strength would be increased only slightly, say 10 to 15%.

As another example partially dried paper may be sprayed on a papermaking machine. Suppose for example the paper at the point of spraying contains 40% water. Then the spraying solution would consist of the following:

	Per cent
Dimethylolurea	20
Secondary ammonium phosphate	1.5

The amount of this solution applied would be 6% of the weight of the dry paper, and the moisture content of the sheet would be increased from 40% to 42%. The paper is then dried in the normal way. With the use of the ammonium phosphate catalyst no neutralization step is required.

The degree of wet-strength obtained, other things being the same, is within certain limits a function of the amount of urea-formaldehyde used in proportion to the fibre treated. For example, with paper toweling the use of urea-formaldehyde in amount of 1% on the basis of fibre increases the wet-strength approximately four to five times. The use of 2% increases the wet-strength approximately six to seven times. In either case, the dry strength and other physical properties of the paper are substantially unchanged. The fact that there is substantially no change in the dry-strength of the paper is to be particularly noted, since this indicates that very little, if any, of the resin is acting as an additional interfibre cementing medium. This is accounted for by the fact that the urea-formaldehyde resin, when used under the conditions specified and in the proportions contemplated by the invention, is sufficiently soluble to remain in solution until the liquid phase has been reduced by drying to that amount which is held essentially within the fibres themselves.

Quantities of urea-formaldehyde less than .5%

of the fibre have very little effect on the wet-strength, while quantities greater than 3% have an appreciable hardening or stiffening effect. I have found in effect that the use of up to approximately 3% of resin results in an inconsiderable increase in the stiffness of the paper, whereas the wet-strength of the paper increases rapidly, as indicated above. Beyond 3% of resin and up to approximately 5%, the increased stiffness while appreciable is still inconsiderable as compared with the great increase in wet-strength. Beyond approximately 5% of resin, however, the rate of increase of wet-strength falls off so rapidly that the advantage gained in this respect is not sufficient, where the quality of softness in the product is required, to offset the disadvantage of the increasing hardness.

It is to be noted that fibres treated as above described are never water-repellent. If the resin is used in such large amounts, say in excess of 5% on basis of fibre weight, that considerable amount of condensation product exists between the fibres, absorbency or penetration of water into the interfibre spaces is impaired, but no apparent water-repellency, as such, exists.

In the application of the present invention certain modifying ingredients may be used along with the urea-formaldehyde. In particular, the use of protein matter, e. g., soya bean protein, casein or gelatin in amounts of 10% to 50% of the urea-formaldehyde has the effect of making the paper more resistant to exposure to water over long periods of time and at elevated temperatures. In the foregoing description, the preparation of a resin formed by reacting a urea and an aldehyde is described, and the use of a catalyst in the preparation of the resin from the urea and the aldehyde is recommended. In the claims, the phrase "a resin formed by the reaction of a urea and an aldehyde only" is employed to distinguish the urea-aldehyde resin from a product in which a third material is one of the resin-forming ingredients with the urea and the aldehyde in the preparation of the resin. This expression in the claims, of course, includes the preparation of the resin from a urea and an aldehyde in the presence of a catalyst.

In previous proposals paper has been heavily filled with resins to an extent largely modifying the normal paper characteristics, but the distinctions between these prior products and the processes by which they are produced and those according to the present invention will be apparent from the foregoing description.

I claim:

1. A high-wet-strength paper containing from approximately .5 of 1% to 5% on the basis of the dry weight of the paper, of a resin formed by reacting a urea and an aldehyde only, said aldehyde being a saturated aliphatic aldehyde having from 1 to 4 carbon atoms and said resin being in substantially cured condition.

2. A high-wet-strength paper containing from approximately .5 of 1% to 3% on the basis of the dry weight of the paper, of a resin formed by reacting a urea and an aldehyde only, said aldehyde being a saturated aliphatic aldehyde having from 1 to 4 carbon atoms and said resin being in substantially cured condition, said resin-containing paper having a marked increase in wet-strength and substantially the water-absorbency and softness of the same paper free of resin.

3. A high-wet-strength paper containing approximately 2% on the basis of the dry weight of the paper, of a resin formed by reacting a urea and an aldehyde only, said aldehyde being a saturated aliphatic aldehyde having from 1 to 4 carbon atoms and said resin being in substantially cured condition.

4. A high-wet-strength paper containing from approximately .5 of 1% to 5%, on the basis of the dry weight of the paper, of an acid-polymerized resin formed by reacting a urea and an aldehyde only, said aldehyde being a saturated aliphatic aldehyde having from 1 to 4 carbon atoms and said resin being in substantially cured condition.

5. A high-wet-strength paper containing from approximately .5 of 1% to 3%, on the basis of the dry weight of the paper, of an acid-polymerized resin formed by reacting a urea and an aldehyde only, said aldehyde being a saturated aliphatic aldehyde having from 1 to 4 carbon atoms and said resin being in substantially cured condition, said resin-containing paper having a marked increase in wet-strength and substantially the water-absorbency and softness of the same paper free of resin.

6. A high-wet-strength paper containing from approximately .5 of 1% to 5% on the basis of the dry weight of the paper, of a resin formed by reacting urea and formaldehyde only, said resin being in substantially cured condition.

7. A high-wet-strength paper containing from approximately .5 of 1% to 3%, on the basis of the dry weight of the paper, of an acid-polymerized resin formed by reacting urea and formaldehyde only, said resin being in substantially cured condition, said resin-containing paper having a marked increase in wet-strength and substantially the water-absorbency and softness of the same paper free of resin.

8. A high-wet-strength paper containing from approximately .5 of 1% to 5% on the basis of the dry weight of the paper, of an acid-polymerized resin formed by reacting a urea and formaldehyde only, said resin being in substantially cured condition.

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CLEANING AND ANTIMIST FILM APPLYING ARTICLE

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2 Claims. (Cl. 15—209)

This invention relates to an article for cleaning and applying an anti-mist film to glass surfaces or the like. The invention relates more particularly to such an article serviceable for cleaning polished surfaces to a highly transparent or perfectly reflective condition and at the same time to make such surfaces highly resistant to the formation of misting films which tend to mar their polished transparency or reflectivity.

Cleaning and anti-mist treatment of polished surfaces has been hitherto accomplished by first applying a smear of anti-filming or anti-misting compound upon the surface, sometimes by spraying and other times by rubbing, and then wiping the smear clean with fresh rags or other absorbent materials. This is time wasting and inconvenient, in that it involves two separate operations, and also because it requires a plurality of cleaning elements. In view of this inconvenience, in most cases, people wait until vision has become dangerously obscured before wiping the glass clean.

In accordance with my present invention, the cleaning and anti-misting treatment can be reduced to a single operation by the use of a single carrier suitably processed so that it functions simultaneously for cleaning and applying the anti-mist film to the polished surface. Polished surfaces which are effectively treated by the use of the material of the present invention are eyeglass lenses, bathroom mirrors, automobile windows and windshields, refrigerated show cases, and the like, and in fact, any polished surface of a transparent or reflective nature the function of which is directly impaired by lack of cleanliness and by misting films formed thereon.

I have found that a flexible carrier such as a soft tissue paper or cloth may be combined with an anti-mist material in such a way that the cleaning operation and the anti-mist film applying operation may be accomplished at one and the same time and in a very simple and facile manner. This is done by combining the flexible carrier with the anti-mist material so that the anti-mist material is held on the carrier in such a way as to allow transfer of the said material to the polished surface such as glass and the like, to produce a thin, anti-mist film thereon at the same time and while the glass surface is cleaned by the carrier. I have also found that it is essential to apply the anti-mist material to the carrier in a predetermined quantity large enough in amount to leave on the cleaned surface a thin, anti-mist film, yet insufficient in amount to interfere in the first place with the cleaning effect of the carrier, or in the second place, to leave upon the cleansed surface any visible smear.

When the flexible carrier is thus suitably processed and contains the workable amount of anti-mist material, the carrier may be used as an ordinary piece of cleansing tissue or cloth is used and will function for simultaneously cleansing the polished surface and applying thereto a thin, invisible anti-mist film.

The flexible carrier which is preferably employed is a porous material such as a soft tissue paper or cloth, which is adapted for use in wiping and cleaning polished surfaces such as glass or the like. The carrier should be free from any abrasive material which would scratch or mar the polished surface, and should also be free of any detachable particles which would tend to deposit themselves and remain on the polished surface after a wiping or cleansing operation. The carrier should preferably be fine textured, soft and porous in order to pick up foreign matter and absorb any moisture and grease which may be on the surface to be wiped, and also so that it may properly receive and have deposited thereon the anti-mist chemical with which it is treated to produce the product of the present invention.

This soft tissue paper or cloth flexible carrier is treated with the anti-mist chemical. Such chemicals are well known; they comprise water soluble and foaming materials, such as elm-bark, acacia, ordinary soap and generally most stearates, oleates, palmitates, etc. The treatment is made in any of a number of ways as is set forth in the examples hereinafter given. I have found that the desired results can only be obtained by the combination of the flexible carrier with an extremely minute and generally critical amount of the anti-mist chemical. If too much of the anti-mist chemical is employed, there results on the polished surface a visible film or smear that continued rubbing will not satisfactorily remove. Furthermore, the use of too much of the anti-mist chemical has a tendency to interfere with the cleansing function of the flexible carrier. On the other hand, if an insufficient amount of the anti-mist chemical is used on the carrier, although the polished surface may be wiped clean, no anti-misting film will be formed; the anti-mist material is, therefore, deposited on the carrier in a predetermined quantity large enough in amount to leave on the clean surface the thin, anti-mist film desired. While the amount of the anti-mist chemical applied is generally critical, it is dependent upon a number of factors, prime among which are the method of applying the chemical to the carrier, the nature of the carrier, and the character of the anti-mist chemical.

I have found that the carrier may be treated with the anti-mist chemical in either of two ways to produce the proper combination of the carrier and the anti-mist material, and that in both a uniform deposit of the chemical per unit area of the wiping surface may be effected.

Impregnation method.—The anti-mist material may be applied to the carrier by impregnation. This is accomplished by spraying or dipping the carrier with a fairly concentrated water solution of the chemical. With a pure fairly dry soap a concentration of about eight per cent (8%) by weight is convenient. The application should be such as to result in the even distribution of dry soap in the tissue paper carrier, so that the paper contains about seven per cent (7%) of soap by weight. This amount may also be defined volumetrically, as thinner and lighter papers require less weight of soap per unit area. The applied amount is dependent upon the kind of soap used. I have found that if impregnation is attempted with water-washed pieces of soap, about three times as much soap must be applied in order to obtain the desired effect. It would appear that these water-washed pieces must have had some of the most active anti-mist components bleached out. Furthermore, I have found that the chemical composition of the soap will also determine its optimum amount; for example, if a tissue be impregnated with pure sodium stearate, only one-half of one per cent of soap by weight is required. Furthermore, it has been found that an important advantage of using sodium stearate in such small amounts is that even if several times the amount of stearate necessary to form a film is used, it still is such a small amount that the excess does not form a smear. This is significant because it allows a very desirable leeway in the case of quantity manufacture.

Coating method.—Another way of preparation is by surfacing or coating the tissue with an extremely fine layer of the chemical. This is, generally speaking, more economical of the chemical, for I have found that slightly less than one-third milligram of dry soap per square inch per side of carrier is required. An advantage of the surfacing method is that for some uses, such as spectacle lens cleaning, only one side of the carrier need be coated, it being preferable to surface only one side in order that the fingers of the user be not soiled or imparted with a greasy film. It should be noted, in this respect, that with clean new soap, the undesirable effects of coating both sides of the paper are minimized greatly, because the amount of soap used is decreased. Further, when sodium stearate is used the necessity for coating only one side is greatly diminished. In order to compare the amount of soap used in this process with the amount of soap used in the impregnation process, it is well to keep in mind that suitable tissues will weigh about 25 milligrams per square inch and therefore will contain about 1.75 milligrams of soap per square inch of tissue after impregnation.

It is important that the chemical be evenly distributed over the surface of the wiping element in order that it may be evenly applied to the surface to be wiped. I have found that a preferred way of accomplishing this is to permit lumps of soap to lightly tumble against a soft surfaced roller adapted to pick up a fairly uniform layer of soap film. This film may be transferred in predetermined amount by rotating the roller against the tissue carrier passing thereover. Regulating the amount of soap transferred may be accurately accomplished by varying the relative speeds of the roller and tissue and the pressure of contact.

I have found it desirable to use a compound of sodium stearate and potassium oleate as the anti-mist chemical for certain purposes. In some applications of the use of sodium stearate, particularly if too much is applied to the tissue carrier and especially after the tissue carrier is crumpled, there is a tendency of the anti-mist chemical to flake off and to deposit as a powder on the wiped surface. I have found that this objection may be obviated if one-half as much of potassium oleate is added to the sodium stearate. This anti-mist compound has the further advantage that the amount used is not as critical as when sodium stearate is used alone and, consequently, there is greater leeway in the manufacturing method. The addition of potassium oleate also diminishes the jelling tendency of the soap and, consequently, makes for easier preparation.

The cleaning and anti-mist film applying article of the present invention may be prepared in the form of different packages and of appropriate sizes. For a vest pocket size and for personal use, the processed tissue carriers may be put up in stacked looseleaf form or in book form. Such a package may be readily carried in the consumer's pocket and the tissues may be individually stripped from the package as required for use. For household and automobile use, larger packages may be made with the individual tissues or fabric carriers stacked or interleaved.

The method of making and using the cleaning and anti-mist film applying articles of the present invention will, in the main, be fully apparent from the above detailed description. The flexible carrier may be readily processed either by the impregnation or coating method, and suitable sheet sizes thereof may be appropriately arranged in packages made most convenient for the particular intended use. The processed carrier sheets are used singly for each wiping application, and by the use thereof the polished surface is simultaneously cleansed and coated with anti-mist film. With a single wiping application, it is found that the treated polished surface will resist the formation thereon of moisture films for a substantial period.

It will be apparent that while I have described the product of the invention and the method of making the same in the ways now found to be preferred, that many modifications may be made therein without departing from the spirit of the invention defined in the following claims.

I claim:

1. An article for simultaneously dry cleaning glass surfaces or the like and applying thereto an anti-mist film comprising, a relatively dry flexible carrier of the class of tissue paper effective for dry cleaning and polishing the glass surface, and impregnated with about one-half per cent by weight of pure sodium stearate, the sodium stearate being distributed in a relatively dry state over said carrier and being critically small in amount to allow transfer of the same to the glass surface when dry cleaned by said carrier to produce a thin anti-mist film thereon.

2. An article for simultaneously dry cleaning

glass surfaces or the like and applying thereto an anti-mist film comprising, a tissue paper carrier effective for dry cleaning and polishing the glass surface, and a relatively dry anti-mist material distributed over and held by said carrier, the said tissue paper being of a weight of about 25 milligrams per square inch and the said anti-mist material being deposited on said carrier in about ⅓ milligram per square inch, the said anti-film material functioning to leave on the glass surface when dry cleaned by said carrier a thin anti-mist film without interfering with the cleaning effect of the carrier or leaving upon the said surface a visible smear.

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