THE CHEMICAL FORMULARY

A CONDENSED COLLECTION OF VALUABLE, TIMELY, PRACTICAL FORMULAE FOR MAKING THOUSANDS OF PRODUCTS IN ALL FIELDS OF INDUSTRY

VOLUME III

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PREFACE TO VOLUME III

Because of an insistent demand for new and additional formulae Volume III of the Chemical Formulary is being published a year in advance of original plans. In technical chemical compounding there is no rest or "breathing-spell"—no "status quo." Improvements are being made daily and new ideas and methods are continually being initiated and applied. New sources of data in many fields are being opened up in order to increase the breadth and scope of information.

As far as possible there has been included information especially requested by users of Volumes I and II. Diligent cooperation on the part of many chemists, engineers, teachers, technicians and other workers has made this possible.

The editor-in-chief wishes to thank all those who have helped in this work, which, in so short a time, has found a place as a highly useful tool and time-saver at the right hand of so many technical workers. In many cases it has proved to be a veritable catalyst in stimulating new products and processes.

Any thoughts for improving succeeding volumes and any new formulae or data, will, as heretofore, be most welcome. To make reference more easy the index in this volume is inclusive of Volumes I, II and III so that three separate indices need not be consulted.

H. BENNETT

ABBREVIATIONS

amp.	ampere
avoir.	avoirdupois
b.p.	boiling point
Bé.	Baumé
C.	Centigrade
cc.	cubic centimeter
c.d.	current density
c.p.	chemically pure
cu. in.	cubic inch
cu. ft.	cubic foot
d.	density
dil.	dilute
dr.	dram
F.	Fahrenheit
f.f.c.	free from chlorine
f.f.p.a.	free from prussic acid
fl. dr.	fluid dram
fl. oz.	fluid ounce
g.	gram
gr.	grain
hr.	hour
kg.	kilogram
l.	liter
m.p.	melting point
min.	minute
min.	minims
N	Normal
pH	Hydrogen-Ion Concentration
Q. S.	A quantity sufficient to make
r.p.m.	revolutions per minute
sec.	second
Sp. G.	specific gravity
Sq. dm.	square decimeter
U.S.P.	U. S. Pharmacopeia
V.	voltage
wt.	weight

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ADHESIVES

White Glue

A solution consisting of:

Animal Glue	100 oz.
Zinc Oxide	50 oz.
Water	100 oz.

gives a glue which sets quite hard and is very strong.

Glue

Urea	1 lb.
Casein	2 lb.
Hydrate of Lime	¼ lb.

Black Albumen from Blood

Let slaughterhouse-blood stand in shallow dishes or pans, cut the blood jelly, sift the serum off. The residue is stirred in water to a paste, and put *through a filter press.* Evaporation in vacuum produces from the second filtrate the dark black albumen used for veneering and laminating.

"Salamyn-Plant" Glue

a.	Potato-Starch	35 kg.
	Water (35° C.)	105 l.
b.	Caustic Soda (35° Bé.)	15 kg.
c.	Hydrochloric Acid	about 10 kg.
	Water	10 l.
d.	Upholsterer's Glue	260 kg.

Stir *a* for ¾ hour after adding *d.* Stir with *b* until glassy, then add *c.*

Calcium Saccharate Glue

Water, Boiling	70 g.
Sugar	6 g.
Lime, Fresh Slaked	1.5 g.

Let stand, stir often, cover. After a few days pour off from bottom deposit, and soak in the solution,

Carpenter's Glue	60 g.

then warm to solution.

Marine Linoleum Cement

Decks to be covered with linoleum should be thoroughly cleaned, and the linoleum stuck to the deck with the following adhesive:

To make 10 gallons, first cut 4 oz. of crude (ham) rubber into small lumps and dissolve in 4½ gallons of gasoline. It will require about two days to get the rubber into colloidal solution. When in proper condition it should string about two inches thumb and forefinger. Cut 19 lb. of gum shellac in 34 lb. of denatured (or wood) alcohol. Add 62 lb. of whiting then add the rubber solution. For best results this mixture should be ground in an iron or pebble mill.

Linoleum Glue

a.	Rye or Barley Flour	50 kg.
	Water, tepid	250 l.
b.	Caustic Soda (20° Bé.)	20 kg.
c.	Turpentine, Venice, melted	20–25 kg.

Part *a* dispersed by stirrer is mixed with *b* (dissolved). The mixture is then boiled, and after cooling emulsified by adding *c* (while stirring add).

Painters' Glue (Cold)

Water (25° C.)	350 l.
Potato-Starch, Powder	100 kg.
Rosin, Finely Ground	21 kg.
Caustic Soda (24° Bé.)	56 kg.

Mix altogether with strong stirring for 2–3 hours, let stand 1 hour, and neutralize with dilute nitric acid until red color with phenolphthalein disappears (in a sample). Stir ½ hour more.

Wall Size

Aluminum Stearate	4 oz.
Turpentine	25 oz.
Mineral Spirits (150–190° C.)	71 oz.

Heat the turpentine to 180° F. and add the stearate slowly while stirring continuously. Add mineral spirits and stir until clear.

Painters' Size

Potato-Starch (Air-Dried)	7.8 g.
Calcium Chloride	7.0 g.
Water	3.0 g.

The aqueous paste, when compact, is dried and ground. The excess chloride can be extracted with aqueous alcohol, yielding a better paintable and quicker drying product.

Paperhanger's Paste

Use a cheap grade of rye or wheat flour, mix thoroughly with cold water to about the consistency of dough or a little thinner, being careful to remove all lumps. Stir in a tablespoonful of powdered alum to a quart of flour, then pour in boiling water, stirring rapidly until the flour is thoroughly cooked. Let this cool before using and thin with cold water.

Venetian Paste

a. White or Fish Glue	4	oz.
Cold Water	8	oz.
b. Venice Turpentine	2	fl. oz.
c. Rye Flour	1	lb.
Cold Water	16	fl. oz.
d. Boiling Water	64	fl. oz.

Soak the 4 oz. of glue in the cold water for 4 hours. Dissolve on a water-bath (glue-pot) and while hot stir in the Venice turpentine. Make up *c* into a batter free from lumps and pour into *d*. Stir briskly, and finally add the glue solution. This makes a very strong paste, and it will adhere to a painted surface, owing to the Venice turpentine in its composition.

Flour Paste

a. Wheat Flour	2	lb.
Cold Water (1 quart)	32	fl. oz.
b. Alum	1	oz.
Hot Water	4	fl. oz.
c. Boiling Water	96	fl. oz.

Work the wheat flour into a batter free from lumps with the cold water. Dissolve the alum as designated in *b*. Now stir in *a* and *c* and, if necessary, continue boiling until the paste thickens into a semi-transparent mucilage, after which stir in the solution *b*. This makes a very fine paste for wallpaper.

Sinclair's Glue

Formula No. 1

"Very Good" Glue or Gelatin	50 oz.
Water	100 oz.
Glycerin	4 or 6 oz.
Thymol or Menthol	0.15 oz.

The smaller amount of glycerin is for summer or tropical use, and the larger amount for winter. Gelatin is preferable, for commercial glue varies in quality and generally requires neutralizing to litmus with weak alkali. The following is a simple test for a "very good" glue. "On soaking glue in excess of cold water overnight, a gelatinous *coherent* mass is obtained, weighing, when drained, at least four times the weight of the original glue." With the very best glue a mass weighing five times the original weight is obtained.

No. 2

Isinglass	50 oz.
Gelatin	50 oz.
Water	200 oz.
Tannic Acid	12 oz.
Glycerin	8 or more oz.
Menthol or Thymol	0.15 oz.

This forms a stronger adhesive, is perhaps more elastic, and has the advantage of somewhat hardening the skin so that the tendency to blistering is almost completely eliminated.

Marine Glue

Rubber	100 g.
Turpentine	600 g.
Coal Tar Oil	600 g.
Shellac	300 g.

Warm together and mix till smooth.

Preserving Glue

Add 3 ounces of ordinary borax to each gallon of glue or add 1 ounce of formaldehyde to the gallon or 1 ounce of carbolic acid. Adding ½ ounce of 28% acetic acid to 2 pounds of glue will also prevent the souring and also has a tendency to make it waterproof.

Casein Glue

Formula No. 1

Casein	100 oz.
Water	220 to 230 oz.
Hydrated Lime	20 to 30 oz.
Water	100 oz.
Silicate of Soda	70 oz.
Copper Chloride	2 to 3 oz.
Water	30 to 50 oz.

The 220 to 230 parts of water added to the casein is approximately the right amount to use with Argentine (naturally soured) casein; but if a different casein is used the water requirement will lie somewhere between 150 and 250 parts by weight. The correct amount for different caseins must be determined by trial.

The formula presupposes that a high calcium lime will be used. A lime of lower grade may be used, but a proportionately larger amount of it will be needed, or the water resistance of the glue will be sacrificed. It is suggested that for the first trial the user try 25 parts of lime. If this does not give

proper results the amount can be varied within the limits specified.

The density of the silicate of soda used should be about 40° Baumé, with a silica-soda ratio of from 3 to 3.25.

Copper sulphate can be substituted for copper chloride.

Place the casein and water in the bowl of a mixing machine and rotate the paddle slowly, stirring the mixture until all the water has been absorbed and all the casein moistened. If the casein is allowed to soak beforehand it is more readily dissolved in the mixing process. Mix the hydrated lime with water in a separate container. Stir this mixture vigorously at first, but just before it is added to the casein stir just enough with a gentle rotary motion to keep the lime in suspension. Pour the milk of lime quickly into the casein.

When casein and lime are first combined they form large, slimy lumps, which are balls of dry casein coated with partly dissolved casein. These break up rapidly, becoming smaller and smaller, and finally disappear. The solution, in the meantime, is becoming thin and fluid. At this point stop the paddle and scrape the sides and bottom of the container, and then stir again. If a deposit of casein remains unacted on, it may cause more lumps later.

When about two minutes have elapsed since the lime and casein were united, it may be noticed that the glue has begun to thicken a little. Add the sodium silicate now, or else the glue will become too thick. The glue will momentarily become even thicker, but this thickness will soon change to a smooth and fluid consistency.

Continue the stirring until the glue is free from lumps. This should not take more than 15 or 20 minutes from the time the lime was added. If the glue is a little too thick, add a small amount of water. If the glue is too thin, it will be necessary to start over again, using a smaller proportion of water.

The copper salt may be added at any one of several times during the mixing process. If added as a powder before the casein is soaked, it may have a corrosive action upon the metal container. The copper salt, if added as a powder, should be thoroughly mixed with the casein before the addition of the lime. Copper salt may be placed in solution and conveniently stirred into the moistened casein immediately before the lime is added or after all the other ingredients have been combined. If the copper solution is added at the end of the mixing period, pour it into the glue in a thin stream and stir the mixture vigorously. Continue stirring until any lumps, which may have formed by the coagulation of the glue and the copper solution, are broken up and until a smooth violet-colored glue is obtained.

Glue prepared by this formula has proved to be exceptionally strong and durable, even under wet or damp conditions.

Formula No. 2

The mixing is the same as for above formula except for the omission of the copper chloride. The glue made by this formula has a medium consistency, excellent working properties, a good working life, and makes joints of high strength, but it falls somewhat short of the previous formula in water-resisting properties, especially when the lower amounts of lime are used.

Casein	100 oz.
Wate	200 oz.
Sodium Hydroxide (Caustic Soda)	10 oz.
Water	50 oz.

Bring the casein and water together according to the directions for mixing glue prepared by previous formula. Dissolve the caustic soda in water in a separate container, and while the mixing paddle is revolving sprinkle the caustic soda solution into the damp casein. Stir slowly until a thin, smooth glue has been obtained. The consistency of the finished product may be altered by adding more casein if it is too thin, or by adding water if it is too thick. Silicate of soda is sometimes added to thicken or to reduce the cost of the glue per unit of volume.

This glue has exceptional strength when dry, but when exposed to moisture it weakens as rapidly as animal or vegetable glue.

Cold Glue (Casein)

Formula No. 1

a.	Casein, Dry	70 g.
	Trisodium Phosphate	10 g.
	Lime Hydrate	20 g.
	Sodium Fluoride	3 g.
b.	Water	200 g.
	Pine Oil	2 g.

a is soaked with *b*.

No. 2

a.	Casein	60 g.
	Lime, Hydrated	15 g.
	Trisodium Phosphate	4 g.

Sodium Fluoride	4 g.
Nut Meal	17 g.
b. Water	200 g.

Stir *a* with *b*; paste ready after 20 minutes.

No. 3

Casein	20–30 g.
Caustic Soda (36° Bé.)	0.2–0.6 g. or 0.7–2 g.
Water	79.8–68 cc.

No. 4

Casein	20–30 g.
Soda Ash	2– 4.5 g.
Water	78–65.5 cc.

No. 5

Casein	20–30 g.
Borax	2– 5 g.
Water	78–65 cc.

No. 6

Casein	20–30 g.
Ammonia (sp. gr. 0.910)	10–24 cc.
Water	70–46 cc.

No. 7

Casein	12 g.	Knead
Borax	1.5 g.	
Ammonia (0.91)	1.5 g.	
Water	85 g.	

No. 8

Casein	20 g.	soak
Water	60 g.	
Disodium Hydrogen Phosphate	3 g.	dissolve; Knead
Water	20 g.	
Caustic Soda (10%)	6 g.	

Mix all in warm water-bath.

No. 9

Casein	20 g.	Warm for ½–1 hour
Water	80 g.	
Borax	1 g.	
Ammonia (0.91)	2 g.	
Caustic Soda (36° Bé.)	2 g.	

Cool, at 50–60° C., add:

Waterglass (30° Bé.)	8 g.
Alcohol, Denatured	2 g.

Impregnation Glue

Casein	15–20 g.
Ammonia (sp. g. 0.910)	8–16 cc.
Water	77–64 cc.

"Pastel" Glue

Casein	25 g.
Ammonia (0.910)	20 cc.
Water	50 cc.
Glue Jelly	5 g.

Modern Casein Adhesive Powders

For use stir with *140 times* the amount of water (cold). After ½ to ¾ hour, a homogeneous, viscous solution is gotten ready for use.

Formula No. 1

Lactic Acid-Casein	70 g.
Marble-Lime Hydrate	13 g.
Trisodium Phosphate	5 g.
Sodium Fluoride	4 g.
Sodium Sulphate, Pure, Anhydrous	6 g.
Naphtha, Refined	2 g.

No. 2

Lactic Acid-Casein	60 g.
Slaked Lime	20 g.
Trisodium Phosphate	10 g.
Aniline	8 g.
Mineral Oil	2 g.

No. 3

Lactic Acid-Casein	50 g.
Slaked Lime	16 g.
Trisodium Phosphate	8 g.
Sodium Sulphite	8 g.
Sodium-Waterglass, Dry	6 g.
Copper Chloride	2 g.
Hardwood-Meal	10 g.
Mineral Oil	1½ g.

Air-plane Propeller Glue

1. Black Blood Albumen	1 g.	Mix at 15° C., stop mixing for two hours
Water	6 g.	
Add:		
Slaked Lime	0.06 g.	Mix until thick
Water	1 g.	

Mordant for Handles of Kitchen-Knives

a. Potassium Bichromate	15 g.
Water	1000 cc.
b. Ammonia (25%)	150–200 g.

Dissolve the chromate *a*, and add *b*.

Treat wood with solution, dry, rub over with a hard brush (horse-hair), optionally a thin polish.

Wood Veneer Adhesive
U. S. Patent 1,964,960

Casein	1 oz.
Ammonium Sulphocyanate	2 oz.
Paraformaldehyde	.02–0.4 oz.
Water sufficient to make fluid.	

This will remain fluid for several hours at ordinary temperature. Coagulates on heating to give strong bond.

Cement for Filling Cracks in Wood

Consists of a mixture of 150 parts linseed oil, 30 parts varnish, 40 parts wax, 30 parts gypsum, 750 parts pigment.

(*Note:* Generally, wax is an objectionable constituent, from the standpoints of lessening adherence within the crevices and lack of cohesion of finishing coatings applied over such filled areas. Preferable material would be the present well-known plastic wood and wood doughs which are pyroxylin-base products utilizing wood flour. Representative composition (U. S. Patent 1,838,618) is Celluloid Scrap 19 lbs., Ester Gum 8 lbs., Castor Oil 3 lbs., Methyl Acetone 44 lbs., Wood Flour 26 lbs.; and if pigmentation may be desired, as follows—Celluloid 10, Ester 7, Castor 4, Acetone 15, Benzol 15, Alcohol 5, Wood Flour 24, China Clay 20.

Cheaper materials more popular with painters and decorators are the Water Putties in dry powder form; they are used for filling cracks and holes in wood trim, also for filling the spaces between flooring in both old and new floors. When thoroughly dry the applied putty has no tendency to shrink or crack. One product on the market for years is composed of 10 parts Quartz Silica, 2 parts Plaster of Paris, 1½ parts Dextrin. Pulverized Gum Arabic could be substituted for the dextrine and effect greater hardness; and addition of about one-half part of wood flour or fine sawdust would enhance the toughness of the putty. For using, only enough water is mixed with the putty powder to the consistency of regular commercial putty).

Wood Veneer Glue

Blood Albumen	40 g.
Casein	12 g.
Slaked Lime	6 g.
Sodium Fluosilicate	2 g.
Wood Meal	40 g.

Apply the adhesive by putting it on both sides of the middle piece of wood. If the adhesive is just too viscous, homogenize the adhesive layer. The wood pieces are put together, then pass through drying chambers at 90–95° C., under a pressure of 12–18 kg. per cc. until the albumen is coagulated.

Sealing Preparation for Wine-Barrels

Vaseline (40–42° C.) or so-called "*Traction-Paraffine*" (42–44° C.)	98–98.5 g.
Tallow, Hard Fat or Palm Oil	2– 1.5 g.

Impregnating "Green" Wood
Austrian Patent 142,431

Cover with the following paste and allow to remain until dry.

Sodium Fluoride	80 lb.
Sodium Dinitrophenolate	15 lb.
Kieselguhr	5 lb.

Water sufficient to make paste.

Gum Arabic Glue

Gum Arabic	15–20 g.
Lime Water, Saturated	10–20 cc.
Glycerin	1– 3 g.
Water	74–27 cc.

Mucilage

Gum Arabic, Amber Sorts	100 lb.
Water	150 lb.

Heat and stir until dissolved.

Strain and add

Oil of Cloves	5 oz.
Oil of Wintergreen	5 oz.
Salicylic Acid	5 oz.

Photo-Paste

Gum Arabic	30 g.
Saturated Lime Water	15 cc.
2% Tragacanth Solution	10 cc.
Water	45 cc.

Cold Water Paste
Australian Patent 8259

Wheat Flour	8 oz.
Alum	1 oz.
Water	8 oz.

Mix till smooth; evaporate till dry; powder.

Pasting Paper on Metal Surface

1. Clean off grease with hot soda solution.
2. Roughen with emery paper.
3. Prepare glue:

a. Water	4 kg.
Calcium Chloride	1 kg.
b. Bone Glue	1–2 kg.

Dissolve *a*, then swell *b* in the solution for 24–30 hours; heat on water bath to obtain solution.

Moldex or other preservative 0.1–0.2%.

Vegetable Mucilage

a. Water (Above 16° C.)	200 l.
Potato-Starch	100 kg.
b. Caustic Soda (35° Bé.)	28 kg.

Stir *a* to dispersion, sift, add slowly *b* under stirring, until glassy. Keep temperature low if *thick* mucilage is wished.

Higher temperature yields more fluid glues.

Library Adhesive Paste

a.	Capillary Syrup (42–44° Bé.)	70 kg.
b.	Water, Boiling	20 l.
	Borax	8 kg.
c.	Caustic Soda (40° Bé.)	2–3 kg.
d.	Sulphurous Acid (5° Bé.)	0.5 kg.
e.	Formalin	0.5 kg.

Add *b*, *c*, *d*, *e*, in the given order separately to *a*, stirring strongly. When ready, dye with a little burnt sugar color.

Carton Glue

Dextrin, Light	100 g.	dissolve hot
Borax Solution (10%)	70 g.	dissolve hot
Caustic Soda (40° Bé.)	5 g.	add when cool

Let stand several days.

Cardboard Glues

1.	Casein	13 g.
	Trisodium Phosphate	1 g.
	Ammonia (0.91)	2 g.
	Water	85 g.
2.	Casein	10 g.
	Borax	2 g.
	Glucose	2 g.
	Waterglass (30° Bé.)	15 g.
	Water	71 g.

Padding Glue

1.	Glue (Nat. Assoc. 8–10 Grade)	10 lb.	
2.	Glycerin	10 lb.	
3.	Water	12 lb.	2 oz.
4.	Zinc Oxide	1 lb.	3 oz.
5.	Beta Naphthol		¼ oz.
6.	Methyl Salicylate		1 oz.

Mix 2 and 4, then add 5 and 3, and then 1. Let stand over night, warm and stir until uniform; add 6 and pack.

In hot humid weather this glue may set too slowly. This may be corrected by

a. Using a higher grade of glue, or

b. Using less glycerin (which will, of course, reduce flexibility), or

c. Dusting surface after partial drying with talc or precipitated chalk.

Tabbing Compound
U. S. Patent 1,966,389

775 parts of uncoagulated vulcanized latex, containing 40 to 42% by weight of total solids constitutes the first ingredient.

The second ingredient is prepared by dissolving 50 parts of casein in about 150 parts of distilled water (preferably with the addition of an alkali which may be caustic soda, alkaline sodium salts or ammonia).

Third, 50 parts of egg albumen are dissolved in about 200 parts of water to produce a highly viscous solution.

A fourth component is made by adding 125 parts of a 2% ammonia solution, to 5 parts of dried wood fibre and 5 parts of cellulose flocks (or other fibrous material) and the mixture is stirred until a substantially uniform suspension is produced. A small amount of a deodorant composition such as oil of wintergreen can also be added at this point if desired.

The casein solution and the egg albumen solution are then added slowly with constant stirring to the vulcanized uncoagulated latex, and the stirring is continued until a uniform or homogeneous mass is produced. If desired, suitable coloring materials can be added at this stage and can be thoroughly stirred in.

The ammoniacal liquor containing the fibrous material "fourth component" is then added and the entire mixture thoroughly stirred or churned in order to produce a uniform mixture. This mixture is then ready to be used for tabbing, or it can be simply canned and used at any subsequent time.

For tabbing, the paper is jogged if desired to give a substantially smooth surface of edges, to which one coat of the material is brushed on rapidly. Then after five or ten minutes a second coat is preferably applied. This second coat can be daubed on heavily, and quickly brushed down to a smooth coating. The composition will dry firm and the exposed surface will be substantially free from tackiness in about half an hour or sometimes twenty or twenty-five minutes, depending upon atmospheric conditions. The complete strength of the composition is however not developed for several hours after application. If desired, the tablets can be allowed to stand quiet for several hours, until substantially the maximum strength has developed. The surface can be finally dusted over with a suitable pulverulent material, such as talc powder if desired, although ordinarily this will not be found necessary, since the composition after drying does not stick to other surfaces with which it comes into contact, at least to an objectionable degree.

The brushes or the like used in applying the composition can be readily cleaned by being washed in water, and any of the material which gets onto the hands of the user can be readily washed off with water.

In case the solution becomes too thick, it can be diluted with soft water (preferably rain water or distilled water). Hard water would be injurious to the compound.

Label Gum

Formula No. 1—Fluid

Gum Arabic	30 g.
Saturated Lime Water	15 cc.
Glycerin	1 g.
Water	54 cc.

No. 2—Less Fluid

Gum Arabic	35 g.
Aluminum Sulphate Crystals	2 g.
Glycerin	2 g.
Water	61 cc.

No. 3—Viscous

Gum Arabic	30 g.
Aluminum Sulphate Crystals	2 g.
2% Tragacanth Solution	20 cc.
Water	48 cc.

Label Glue

Formula No. 1

Casein	20 g.
Ammonia (sp. g. 0.910)	16 cc.
30% Rosin Soap	5 g.
Water	59 cc.

No. 2

Water-Resistant

Casein	20 oz.
Ammonia (0.910)	5 oz.
Waterglass (30° Bé.)	6 oz.
Water	70 oz.

Library Mucilage

Formula No. 1—Fluid

Gum Arabic	25 g.
Saturated Lime Water	15 cc.
Glycerin	1 g.
Water	59 cc.

No. 2—Less Fluid

Gum Arabic	40 g.
Lime Water, Saturated	20 cc.
Glycerin	2 g.
Water	38 cc.

No. 3—Viscous

Gum Arabic	20 g.
Aluminum Sulphate Crystals	2 g.
2% Tragacanth Solution	15 cc.
Water	63 cc.

Paper Mucilage

a. Dextrin, Middle Pale	50	oz.
Water	50	oz.
b. Sodium Bisulphite	0.5	oz.
Borax	1.0	oz.
Camphor	a grain	

Stir cold until lump-free, warm until the mucilage is formed. Add *b* for deodorizing and preservation.

Adhesive for "Gumming" Papers

Gum Arabic	30 g.
Saturated Lime Water	15 cc.
Glycerin	2 g.
2% Tragacanth Solution	5 cc.
Water	48 cc.

Paper Bag Glue

Casein	22 g.
Borax	3 g.
Venice Turpentine	3 g.
Water	72 cc.

The casein has to be treated (swelled) at 50–70° C. When treating with ammonia, heat up higher at the end to evaporate the excess. Moldex or other good preservative is to be added after the alkaline treatment in proportions of about 18–25 ounces per 100 gallons. If too viscous or too thin, add or evaporate water.

Let stand to clear up.

Carton Glue

Casein	25 g.
Caustic Soda (36° Bé.)	0.5 or 1.7 g.
30% Rosin Soap	10 g.
Water	64.5–63.3 cc.

Waterproof Adhesive
U. S. Patent 1,965,778

Formula No. 1

Casein	100 lb.
Water	225 lb.
*Wax Solution	3 lb.

No. 2

Vegetable Protein Glue	100 lb.
Water	325 lb.
*Wax Solution	3 lb.

* Consists of:

Carbon Bisulphide	8 lb.
Carbon Tetrachloride	8 lb.
Paraffin Wax	1 lb.

Non-Caking Dextrin Adhesive
French Patent 783,963

Dry adhesives having a basis of dextrin which dissolve in cold water without caking are made by heating dextrin to

about 80° C. for ½ hour with about 1% of a polyhydric alcohol, e.g., glycol.

Mucilage for Paper, Photos, Printed Matter

a. Soft Water	35 g.
Sugar	1 g.
Wheat Starch	3 g.

Warm and stir until glassy.

b. 19 parts of a 20–25% gum arabic solution.

Solution *b* is added to *a* when the starch has become "*glassy.*" Preserve with phenol or oil of cloves.

Gummed Labels for Brass, Tin

Moisten with:

Acetic Acid	8 fl. oz.
Glycerin	2 fl. oz.
Water	6 fl. oz.

U. S. Postage Stamp Glue

Gum Arabic	1 lb.
Starch	1 lb.
Sugar	4 lb.

Distilled Water sufficient to give desired consistency.

Adhesive for Waxed Papers

Formula No. 1

Thickened Spirit-Lacquer

or

Acetyl Cellulose-Solution

No. 2

Rosin	60 g.
Mastic	10 g.
Sandarac	20 g.
Ether	5 g.
Alcohol	75–100 g.

No. 3

Chromium Gelatin

or

Canada Balsam

No. 4

a. Cologne Glue (or Gelatin)	100 g.
b. Acetic Acid, Dilute	200 g.
c. Potassium Bichromate	5 g.

Soak *a* in *b*, then dissolve on steam bath, add *c*.

No. 5

Alcohol	100 g.
Ether	5 g.
Rosin	60–70 g.
Sandarac	20 g.
Mastic	10 g.

Celluloid Cements

Formula No. 1

Pyroxylin	200 g.
Camphor	40 g.
Gum Elemi	8 g.
Amyl Acetate	2600 cc.
Acetone	500 cc.
Methanol	400 cc.

No. 2

Celluloid Shavings	240 g.
Gum Elemi	8 g.
Acetone	500 cc.
Methanol	1500 cc.
Amyl Acetate	1500 cc.

No. 3

Pyroxylin	160 g.
Camphor	40 g.
Methanol	2100 cc.
Fusel Oil	1400 cc.
Castor Oil	280 cc.

No. 4

Celluloid Shavings	40 g.
Gum Elemi	8 g.
Benzol	1000 cc.
Amyl Acetate	1000 cc.
Methanol	800 cc.
Acetone	600 cc.

No. 5

Pyroxylin	150 g.
Camphor	40 g.
Methanol	2525 cc.
Amyl Acetate	1250 cc.

Cement for Safety "Movie" Films

The formula below was developed especially for safety films and acetate type of transparent sheeting.

Cellulose Acetate	4 oz.
Tri-Phenyl Phosphate	2 oz.
Acetone	60 oz.
Di-Acetone Alcohol	9 oz.
Benzol	15 oz.
Methanol	10 oz.

The cellulose acetate of high viscosity film quality is preferred. However, washed safety movie film free from the gelatin coating, or other source of reclaimed cellulose acetate may be used. Instead of tri-phenyl phosphate plasticizers of the toluene sulphonamid type such as the Santicizers may be used.

Movie Film Cement

This composition is effective on either the inflammable or safety type films. In using this cement it is preferable to scrape off the gelatin coating with a knife or steel wool.

Cellulose Nitrate	4 oz.
Tri-Cresyl Phosphate	2 oz.
Ethyl Acetate	55 oz.

Butyl Acetate	14 oz.
Benzol	15 oz.
Methanol	10 oz.

The cellulose nitrate may consist of a good grade of high viscosity nitro-cotton or clean new celluloid scrap or nitrate movie film with the gelatin coatings removed. If new cellulose nitrate is not used, the tri-cresyl phosphate can be reduced about one-half. The solvents are mixed together in the above proportions by weight and the cellulose nitrate added.

Pyroxylin Cement

Celluloid Scrap	40 g.
Amyl Acetate	350 cc.
Wood Alcohol	100 cc.
Ethyl Alcohol, Denatured	50 cc.
Gum Elemi	15 g.

Methyl Cellulose Adhesive

Methyl Cellulose	1 lb.
Water	40–60 lb.

Warm together and stir until uniform.

"Cellophane" Adhesive
U. S. Patent 1,972,448

Chlorinated Polyphenyl Resin (125° C. softening point)	62.5 lb.
Dibutyl Phthalate	5.4 lb.
Silica, Finely Ground	32.1 lb.

Cigarette Paper Adhesive

Formula No. 1

Pectin	54 oz.
Bone Glue, Liquid	13.5 oz.
Bone Glue, Solid	13.5 oz.
Dextrin	19 oz.

No. 2

Pectin	60.5 oz.
Bone Glue, Fluid	16.5 oz.
Bone Glue, Solid	6.6 oz.
Dextrin	12.5 oz.
Rye Flour	4.0 oz.

No. 3

Pectin	50 oz.
Bone Glue, Solid	10 oz.
Dextrin	10 oz.
Rye Flour	5 oz.

In the above formulae add sufficient water to make a mucilage of desired consistency.

Primer for Wall Paper Paste
U. S. Patent 2,005,900

Sodium Silicate	50 oz.
Water	44 oz.
Copper Sulphate (12½% Solution)	6 oz.

Mailing Tube Adhesive

Glue, Ground Animal	40 oz.
Water	54.7 oz.
Nitric Acid	5.0 oz.
Phenol	0.3 oz.

Sealing of "Transparit," "Helioglas," or "Cellophane" Packages

a. Methyl Acetate	80 cc.
Ethyl Lactate	20 cc.

b. Collodion-Wool or washed film-scrap, as much as necessary to give a viscous solution (like 30–31° glycerin)

"Cellophane Adhesive"

Arabic, Gum	16.5 oz.
Glycerin	20.5 oz.
Glyceryl Bori-borate	9.0 oz.
Formaldehyde	4.5 oz.

Cardboard and Nitrocellulose Sheet Cement
U. S. Patent 1,969,477

Nitrocellulose	4.5 oz.
Camphor	1.0 oz.
Acetone	30.0 oz.
Ethyl Lactate	10.0 oz.
Xylol	55.0 oz.
Water	5.0 oz.

Liquid Sealing Wax
French Patent 751,683

Turpentine	100 cc.
Shellac	150 g.
Zinc Oxide	30 g.
Methanol	25 cc.

Mix until free from lumps. This dries in air after applying.

Elastic Sealing Wax

Rubber Latex (60%)	165 oz.
Shellac	12 oz.

Warm together with stirring until all moisture is driven off.

De Khotinsky Type Laboratory Cement
Improved Type

Shellac, Flake	100 g.
*Plasticizing Solvent	15 to 30 g.

Heat the solvent to 120° C., and slowly stir in the shellac flakes. When the shellac is thoroughly dissolved and the mixture homogeneous, cool slightly until the mixture pours with difficulty. Immediately pour into long tin molds of about one-half inch square cross section which have previously been treated lightly with petrolatum.

* As a "plasticizing solvent" pine tar has been widely recommended, but is inferior,

since the excessive amount of 60 to 100 grams is required. The oil distilled from white-pine tar over the range of 200° to 325° C. is much better, yielding a tougher cement. Wood creosote or similar mixtures of substances like guaiacol, cresol and other low-melting, high-boiling phenols may be used; also trimethylene glycol or other slightly oxygenated organic solvents of high boiling point. The range of 15 to 30 grams approximately covers the variations of hardness commonly desired.

"Boltwood Wax"

(For cementing physical instruments)

Shellac	40 g.
Rosin	72 g.
Venice Turpentine	8 g.
Beeswax	60 g.
Talc, Dry	16 g.
Tin Oxide, Dry	16 g.

Melt the rosin, add the shellac. Heat to 200° C., add the Venice turpentine and beeswax. Heat the mixture strongly with stirring until it ignites spontaneously. Let it burn until the total mass has shrunk to about 40% of its original weight, then add the talc and tin oxide. This gives a tough, smooth, waxy cement more easily handled on certain delicate instruments than the de Khotinsky type cement.

Leather Sole Cement

Nitrocellulose	22.5 g.
Alcohol	22.5 g.
Benzol	31.1 g.
Ethyl Acetate	9.5 g.
Camphor	1.1 g.
Acetone Oil	0.09 g.
Castor Oil	0.09 g.

Cement for Leather or Leather on Rubber

Gutta-Percha	21.6 oz.
Carbon Bisulphide	17.7 oz.
Benzene	2.9 oz.
Turpentine Oil	23.5 oz.
Asphalt	34.3 oz.

Leather Cement

Celluloid	11.9 oz.
Naphthalene	1.2 oz.
Acetone	67.1 oz.

Cement for Stone and Leather, Porcelain and Leather, Glass and Leather

Crude Rubber	9.1 oz.
Heavy Benzine	45.5 oz.
Japan Wax	13.6 oz.
Colophony	31.8 oz.

Concentrated Rubber Cement
German Patent 599,405

a. Caoutchouc	10 g.
Benzol	90 g.
b. Nitric Acid (52.77%)	1 g.

a gives after 24 hours stirring a homogeneous paste, which is depolymerized by adding *b*. When paste is dissolved, stop reaction by adding barium carbonate. Treat then with antimony trichloride or phthalic acid.

Rubber Cement

(Will firmly fasten rubber to almost any substance)

India Rubber (finely chopped)	100 oz.
Rosin	15 oz.
Shellac	10 oz.
Carbon Disulphide, sufficient to dissolve	

Softening Hardened Shoe Adhesive
German Patent 605,725

Cellulose nitrate adhesives used in shoe cements are softened by the following:

Pyroxylin (1100 second)	62 oz.
Alcohol	26 oz.
Acetone	450 oz.
α-Propylene Oxide	225 oz.

Shoe Repair Cement
U. S. Patent 2,004,059

Crepe Rubber	6 lb.
Rosin	2½ lb.
Accelerator	1½ lb.
Benzene	15 gal.

Porous Leather Sealer

Shellac	14 lb.
Rosin	1 lb.
Alcohol	5 gal.
Butyl Alcohol	¼ gal.
Castor Oil	4 oz.

Leather Belt Cement

a. Glue, Hide	50 g.
b. Water	200 g.

Soak *a* in *b*, pour excess water off, and melt the soaked *a* with:

c. Glycerin	2%
Potassium Bichromate	2%

When cooled, pour into oiled metallic forms; pack the gelatinous product at once into grease-proof paper.

Apply on roughed surface, while the sharpened ends are pressed together for 6 to 10 hours.

Belting Cement

Hide Glue	2¼ lb.
Water	2¼ lb.
Glycerin	9 oz.
Carbolic Acid	3/16 oz.

To use, melt and apply hot to the leather belt and place the joint under pressure until the glue is thoroughly set.

Canvas Awning Cement
U. S. Patent 2,011,218

Rubber Latex	10 oz.
Varnish	1 oz.
Citronella Oil	1/100 oz.
Nigrosine B Solution	1/100 oz.

Textile Glue
(for Doubling of Cloth, Shirting, Drill)

Casein	15 oz.
Soft Soap, Pure	5–10 oz.
Borax	2 oz.
Water	75 oz.

Warm and stir together.

Jute or Burlap Sheet Binder
British Patent 412,498

Gilsonite	11 lb.
Asphalt, Petroleum	23 lb.
Naphtha, Petroleum	35 lb.
Mineral Silicate Filler	15 lb.
Asbestos, Fibrous	15 lb.
Linseed Oil	2 lb.

Upholsterer's Paste

Prepare *a*

a. Calcium Chloride Solution (25° Bé.)
cleared by pouring off solution from settled dirt, and add 160 kg.

to

b. Potato-Starch	100 kg.
Water	100 l.

(Heated to 60–65° C.)

This glue has a good binding power, but dries very slowly and is hygroscopic.

Fine Bookbinder's Paste

Dissolve in

Water, Boiling	100 l.
Trisodium Phosphate	15 kg.
Borax	2.5 kg.
or Alum	10 kg.

and add with stirring, a solution of:

Water, Cold	120 l.
Starch	50 kg.

Warm until fluid.

Upholsterer's and Bookbinder's Paste

a. Potato-Starch	50 kg.
Water, Cold	140 l.
b. Caustic Potash (50° Bé.)	6 kg.
Sodium Silicate	15 kg.
Water, Cold	50 l.
c. Acid to neutralize to weak alkalinity	
d. Rosin Soap, Warm Fluid	5 kg.

Stir *a* till smooth, warm and stir with *b* to form a mucilage. Stir ¾ to 1 hour more, add *c*, then *d*, and stir slowly.

Bookbinder's Paste

a. Rye or Wheat Flour	100 kg.
Water, 25° C.	200 l.
b. Caustic Soda (35° Bé.)	24 kg.
c. Nitric Acid	until neutral
d. Alum, Cold Saturated Solution	20 kg.

Stir *a* to dispersion, treat mildly with *b*, neutralize with *c*, and add *d*.

Adhesive Paste for Rubber-Cloth on Cardboard

a. Gutta Percha, Finely Cut	18 g.
Carbon Disulphide	20 g.
Benzene	10 g.
Turpentine Oil	10 g.
b. Colophony	42 g.

a is mixed and soaked several days, then add *b* with gentle warming.

Mending China, Pottery and Casts

Save all the pieces of the broken article and store where the edges will keep clean until the repair is made. If the edges become soiled they should be washed clean and allowed to dry. The edges may be sanded lightly if necessary to remove the soil. The worker should know where each piece belongs before the work is begun. Small pieces should be cemented together previous to the main repair. A sand box is convenient to hold pieces upright while making the repair leaving both hands free for the work. It is made by putting 8 inches of clean sand in a convenient sized box.

Have at hand the cement, rubber bands, a bowl of warm water, tissue and soft rags. One rag should be reserved for wiping the fingers. Do not work with sticky fingers. Be accurate. If some part is not true after having been put together, soak until the cement is dissolved, wash the edges and begin over. Warm water will dissolve plaster or whiting cement and turpentine or alcohol will dissolve others.

The most durable cement is pure white lead ground in linseed oil, so thick that it will barely spread smooth with a knife. After drying thoroughly (about three months) it makes a seam which is practically indestructible but the mend is very conspicuous.

A less conspicuous cement is made of beaten egg white and sifted whiting or plaster of Paris. A small amount should be mixed at a time as it hardens quickly. In some cases it is just as satisfactory to brush the edges with beaten egg white and dust well with sifted plaster tied loosely in double mosquito netting. The pieces should be fitted together at once and held in place by rubber bands (placed lengthwise, crosswise and diagonally) wrapped loosely in tissue paper and buried in a sand box. Care should be taken that the break lies so that the weight of the sand will hold it together. Leave it in the box at least 24 hours. After a week the superfluous plaster may be scraped away.

Sometimes the rubber bands will not hold the pieces true on a stemmed article, a vase or a jug. In this case string six bands of the same size and strength upon a piece of tape. Tie the tape around the neck or base of the article before beginning the gluing. After the parts are joined slip another tape through the bands and tie above the fracture. The bands pulling in unison will hold the break together. The pressure on all mended fractures should be great enough to force out the tiny air bubbles which otherwise reflect light making the seam conspicuous.

Universal Putty for Wood, Stone, Glass, Porcelain

(Dries after 24–30 hours)

a. Alabaster Gypsum	4 oz.
Gum Arabic	1 oz.

b. Cold Borax Solution, Saturated.

Stir until pasty.

Preserve Jar Sealing Wax

Washes off easily with hot water.

Paraffin Wax	35 g.
Trihydroxyethylamine Stearate	3 g.

Paraffin Bottle Cap Adhesive
U. S. Patent 1,964,380

Chicle	1 oz.
Dammar	1 oz.
Petrolatum, Liquid	½ oz.

Warm and stir until homogeneous.

Bottle-Cap Varnish

Dissolve 2 oz. of red Sealing-wax in 5 oz. of denatured alcohol.

Seal for Bottles

Beeswax	5 g.
Carnauba Wax	1 g.
Paraffin	1 g.
Minium	5 g.
Whiting	2 g.

To Seal Glass Tubing to Iron Tubing

Grind the ends you wish to join to a tapered fit and then seal by fusing with silver chloride.

Cement for Vacuum Tubes

Marble Flour	85 oz.
Shellac	10 oz.
Rosin	5 oz.
Phenol Formaldehyde Resin	25 oz.

Glass to Metal Seals

Formula No. 1

Iron	37 oz.
Nickel	30 oz.
Cobalt	25 oz.
Chromium	8 oz.

The above is suitable for use with lead-glass.

No. 2

Iron	54 lb.
Nickel	28 lb.
Cobalt	18 lb.

Suitable for use with Corning glasses.

Safety Glass Adhesive
U. S. Patent 2,009,029

Formula No. 1

A small portion of casein is heated in an open vessel with twice its weight of glycerol and 1.0% by weight sodium hydroxide (based on the casein). The temperature is brought gradually to 150–165° C. over a period of 15 minutes with continual stirring, and then held at this point for an additional 30 minutes. This product is a clear liquid at 100° but rubbery and very slightly opaque on cooling to room temperature. This material while hot may be pressed between two hot pieces of glass until air bubbles disappear. On cooling a piece of sandwich