THE CHEMICAL FORMULARY

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

VOLUME I

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PREFACE

Chemistry as taught in our schools and colleges is confined principally to synthesis, analysis and engineering—and properly so. It is part of the proper foundation for the education of the chemist.

Many a chemist on entering an industry soon finds that the bulk of the products manufactured by his concern are not synthetic or definite chemical compounds but are mixtures, blends or highly complex compounds of which he knows little or nothing. The literature, in this field, if any, may be meagre, scattered or antiquated.

Even chemists, with years of experience in one or more industries, spend considerable time and effort in acquainting themselves on entering a new field. Consulting chemists, similarly, have problems brought to them from industries foreign to them. A definite need has existed for an up-to-date compilation of formulae for chemical compounding and treatment. Since the fields to be covered are many and varied an editorial board was formed, composed of chemists and engineers in many industries.

Many publications, laboratories, manufacturing companies and individuals have been drawn upon to obtain the latest and best information. It is felt that the formulae given in this volume will save chemists and allied workers much time and effort.

Manufacturers and sellers of chemicals will find in these formulae new uses for their products. Non-chemical executives, professional men and others, who may be interested, will gain from this volume a "speaking acquaintance" with products which they may be using, trying, or with which they are in contact.

It often happens that two individuals using the same ingredients in the same formula get different results. This may be the result of slight deviations or unfamiliarity with the intricacies of a new technique. Accordingly, repeated experiments may be necessary to get the best results. Although many of the formulae given are being used commercially many have been taken from patent specifications and the literature. Since these sources are often subject to various errors and omissions,

due regard must be given to this factor. Wherever possible it is advisable to consult with other chemists or technical workers regarding commercial production. This will save time and money and avoid "head-aches."

It is seldom that any formula will give exactly the results which one requires. Formulae are useful as starting points from which to work out one's own ideas. Formulae very often give us ideas which may help us in our specific problems. In a compilation of this kind errors of omission, commission and printing may occur. We shall be glad of any constructive criticism in this, our first attempt.

To the layman, it is suggested that he arrange for the services of a chemist or technical worker familiar with the specific field in which he is interested. Although this involves an expense it will insure quicker and better formulation without wastage of time and materials.

H. BENNETT
1933

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Box Toe Adhesive

1. Rosin	1300 gm.
2. Shellac	200 gm.
3. Alcohol	1520 c.c.
4. Whiting	4900 gm.

Dissolve one and two in three and then work in four until uniform.

*** Adhesive, Casein**

Casein	50
Magnesium Oxide	3
Soda Ash	1
Water	500
Yeast	1
Sod. Borate	2

*** Adhesive, Casein**

Casein	75
Slaked Lime	15
Kieselguhr	5
Sodium Fluoride	7

Mix the above with water for use.

*** Adhesive, Waterproof Casein**

Soda Ash	15
Sod. Acetate	6
Sod. Fluoride	5
Slaked Lime	45
Casein	140
Basic Copper Carbonate	3

*** Casein, Liquid Adhesive**

Casein	100
Urea	90
Water	100

Mix together and allow to stand until dispersed and free from lumps; this may be hastened by heating to 140–160° F. with stirring. Addition of more water causes thickening or precipitation. This adhesive is fairly water-proof and not alkaline like most commercial casein adhesives.

A glue base which when mixed with water and alkalies produces a smooth glue (having a much longer "life" than a similar material made without casein and seed meal) is formed of dried blood albumin 90, dried milk casein 15–30, a seed meal high in protein material such as peanut, cotton-seed or soy-bean meal 30–45 and finely comminuted cellulose about 100 parts.

*** Adhesive, Moisture-Proof Cellophane**

Ethylene Glycolmonoethylether	20–80%
Lactic Acid	80–20%

The above is mixed with an equal volume of water.

Adhesive for Celluloid to Celluloid

Gum Camphor	1 part
Alcohol	4 parts

Dissolve the camphor in the alcohol and then add 1 part Shellac. Warm to dissolve. This cement is applied warm, and the parts united must not be disturbed until the cement is hard.

*** Celluloid and Rubber, Adhesive for**

Ethyl Crotonate is a solvent for both pyroxylin and rubber. Both surfaces are cleaned and each is wet with Ethyl Crotonate and pressed together.

Cellulose Ester Adhesives

1.

15 parts nitrocotton.
6 parts camphor.
79 parts acetone.
10 parts filler.

2.

20 parts scrap film.
60 parts ethyl acetate.
20 parts ethyl alcohol.
10 parts aluminium powder.

All formulae preceded by an asterisk (*) are covered by patents.

3.

16 parts nitrocotton.
10 parts ethyl acetanilide.
74 parts acetone.
15 parts starch.

4.

12 parts cellulose acetate.
8 parts tricresyl phosphate.
20 parts methyl alcohol.
30 parts ethyl acetate.
30 parts methyl acetate.
25 parts filler.

5.

12 parts nitrocotton.
4 parts ethyl acetanilide.
2 parts castor oil.
20 parts ethyl acetate.
20 parts methyl acetate.
17 parts methyl alcohol.
25 parts starch.

6.

14 parts scrap film.
2 parts ethyl acetanilide.
2 parts castor oil.
3 parts tricresyl phosphate.
13 parts ethyl acetate.
13 parts methyl acetate.
6 parts methyl alcohol.
21 parts acetone.
6 parts benzine.
20 parts starch.

7.

10 parts nitrocotton.
4 parts camphor.
2 parts tricresyl phosphate.
50 parts acetone.
20 parts butyl acetate.
14 parts filler.

Cellulose Ester, Adhesives for

SOLUTION I. 12.8 kg. alcohol-damp nitrocotton in 12.0 kg. methyl acetate.

SOLUTION II. 25.0 kg. first crepe latex dissolved in 72 kg. benzole,

or

SOLUTION I. 7.5 kg. celluloid in 7.5 kg. acetone, 7.5 kg. methyl acetate and 15 kg. ethyl acetate.

SOLUTION II. 17.5 kg. first crepe latex in 72 kg. benzole.

Solutions I and II are mixed and thinned to a suitable viscosity.

An even simpler method consists in dissolving celluloid in acetone or a similar solvent, the layer remaining after evaporation being highly adhesive, soft and elastic, and is not attacked by cold or warm water.

Resins may also be added to the straightforward celluloid solution, in which case a solvent must be selected which dissolves both celluloid and resin. Acetone is probably the most suitable in this connection. Cellulose acetate may be used in place of celluloid, and suitable resins are copal and rosin, the following mixture, for example, giving excellent results:

Celluloid	20 g.
Acetone	60 g.
Copal	5 g.
Rosin	5 g.
White lead	1 g.
Acetone	20 g.

In addition there may be added a small proportion of nitro-benzole, which improves the odour.

An adhesive layer of exceptional properties is obtained by using de-camphored celluloid and castor oil, which are thoroughly incorporated in ethyl acetate or acetone. This adhesive is stable for an unlimited period and may be made up on the following lines:

Castor oil	85 g.
Nitrocellulose	15 kg.

Solvents as required.

Pigments, fillers and odoriferous substances may also be incorporated.

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* Cigarette Tip Adhesive

Nitrocellulose 1.5, rosin 13, tricresylphosphate 13.4, triacetin 1.6, ethylene glycol 2.5, glycol monoformate 5 and lithopone 45 kg.

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* Decalcomania Adhesive

Glue	13.5
Water	28
Butanol	7.3
Toluol	9.7
Alcohol	26.8
Turkey Red Oil	14.7

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* Glass to Cement Adhesive

Glass is coated on one side with a mixt. of Na silicate and a metal oxide, *e.g.*, ZnO, which readily forms a silicate. The glass is then heated gradually to 100°, preferably by heating it to 40°, maintaining that temp. for a few hrs., raising the temp. to 100°, and maintaining that temp. for 1–2 hrs. The solid coating thus obtained does not corrode the glass and adheres well to cement or gypsum.

Glass to Brass Adhesive

Caustic Soda	1
Rosin	8
Plaster of Paris	3
Water	5

Boil together until all lumps disappear and cool before using. This sets in about 20 min.

Quicksetting Insulating Adhesive

Modified Alkyd Resin	11–20
Pyroxylin Solution (35%)	64–73
Tricresyl Phosfate	4–5
Lacquer Thinner	11–21

This is useful on coils and radio parts.

* Latex Adhesives

Latex	100
Invert Sugar	2
Sod. Thiosulfate	3
Pot. Bichromate	2

Latex	100
Albumen	2
Carraghean Moss	5
Formaldehyde	3
Sod. Bichromate	3

Adhesive, Leather Shoe

Good leather adhesives for use by the shoe industry are based on nitrocellulose, rubber or casein. A nitrocellulose compn. contains nitrocellulose 200, AcOAm 15, AmOH 15, rosin 10, camphor 5, Venice turpentine 15 and linseed oil 20 parts. Soft leather is made to adhere especially well by the following compn.: gutta percha 85, rosin 25, asphalt 26, petroleum 130 and CS_2 300–350 parts.

* Adhesive, Mask

Beeswax	52
Lanolin	24
Venice Turpentine	15
Castor Oil	9

* Mica Adhesive

Gilsonite	2
Rubber	1
Benzol	3

Allow to swell and mix properly. This may be thinned down with benzol or naphtha.

* Adhesive, Heat Plastic

The following is used for special adhesive binding tapes.

Balata	10 lb.
Rosin	5 lb.
Mineral Oil	3 oz.

* Synthetic Resin Adhesive

For the prepn. of a transparent weatherproof resin to be used in the manuf. of reflectors for uniting glass particles to a support, a mixt. of PhOH 40, CH_2O soln. 100, and NaOH 1.2 parts is warmed to about 62° for about 2.5 hrs., treated with 3.3 parts of lactic acid, and warmed again to about 60° until the mixt. becomes sirupy.

* Adhesive for Silk or Rubber

Latex	5–15
Rubber	30–52
Rosin	1.5–5
Copal	3–10
Filler	6–25
Color	3–16
Gum Arabic	6–25

* "Masking" Adhesive Tape

For making a paper base or backing, the paper is first submitted to a preliminary treatment by a saturating solution involving a glue base. The saturating solution is composed of the following materials and proportions.

36 pounds of dry glue
72 pounds of water

108 pounds (approx. 16° Twaddell) glue solution. Complete swelling is permitted, assisted by warming.

To this is then added 108 pounds of yellow glycerine.

108 pounds (approx. 16° Twaddell) glue solution
108 pounds pale yellow glycerine

216 pounds glue-glycerine water solution.

To this is added 216 pounds of water.

216 pounds water
2 pounds Formaldehyde

434 pounds

The paper above described is preferably continuously submerged and passed through a bath of the saturating solution as above prepared and then passed through pressure rolls to squeeze off the excess and then dried by heating. It will be observed that just complete saturation is preferred as this step is closely

related to the success or failure of the treatment.

The rubber resin compounds in their solvents may be spread upon the paper backing directly, utilizing a knife spreader to uniformly and equally distribute this material upon the base or backing. The solvent may thereafter be removed by evaporation, preferably without recovering the solvent and leaving the rubber mixture upon the paper backing.

RUBBER RESIN

2 lb. of plantation rubber.
5 lb. of Mexican or wild rubber, high in natural resin content.
1 lb. of zinc oxide pigment.

The ingredients above enumerated are compounded on a rubber mixing roll and then cut to the desired consistency rubber solvent, based upon the necessary viscosity for spreading this material. Ordinarily, the solvent is calculated by the number of pounds of solid compound in one gallon of solvent such as, for instance, 8 pounds of solid or compounded material and 1 gallon of benzol, which is commonly referred to as an 8 pound cut. The variations in proportions of solvent added will depend upon the desired thickness of adhesive coating required in the residuum.

It will be understood that the examples above given are for purposes of getting the requisite adhesiveness in temperate climates. An increase in resinous material or wild rubber may be made for material to be used in colder climates and in warmer climates the resin component may be reduced.

The resinous component may also be varied in its reactions to solvents by choice of the resinous material. Thus, for purposes of removal of the adhesive from some body to which it may be applied, it may be made soluble to various organic solvents, either benzol, gasoline, acetone or alcohol. Thus, where it is desirable to make a surgeon's tape, which is soluble in alcohol, an alcohol soluble resin is added in the examples above cited. Such resin may be Burgundy pitch. This will permit alcohol to be used in removing a piece of adhesive tape from any surface, such as from the skin of a patient, by merely soaking the backing of the tape in alcohol. The rubber, in any event, merely acts as a vehicle for the resin and the character of the adhesive in its reaction to solvents will be dependent upon the character of the resin incorporated with the rubber.

* Adhesive Tape

Plasticized Crepe Rubber	10
Cumarone Resin	2
Zinc Oxide	½

Compound to a plastic mass on a rubber mill and then "cut" to desired body with benzol or naphtha. Before apply ing to cloth or paper the latter should have the reverse treated with a flexible glue (formalized) to prevent soaking thru and sticking. Then apply above mixture with a knife spreader evenly and allow to dry.

Tape, Coating for Adhesive

Heat 10 parts Castor Oil to 270° C. and to it add slowly with stirring 6 parts shellac and 1 part rosin. The addition of glycerol or glycols produces more sticky products.

Tape, Masking

As above except that 9 parts of shellac is used.

Adhesive, Tin

1. Pot. Hydroxide	5
2. Water	56
3. Rosin	50
4. Resinel No. 2	5

Heat one and two to boiling and while stirring vigorously run in three and four which have been melted together: stir until uniform and add

Water	50

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* Adhesive, Vegetable

(a)	Soya bean flour	30
	Alum	1
	Water	70
	Caustic Soda 18%	13
	{ Slaked Lime	4
	{ Water	20
(b)	Cottonseed flour	30
	Alum	1
	Water	70
	Caustic Soda 18%	13
	{ Slaked Lime	4
	{ Water	20
(c)	Low grade wheat flour	30
	Portland Cement	10
	Water	30
	Caustic Soda 18%	30

Warm to 80 C. and add

Sod. Silicate	15

Adhesive Wax

Rosin	100
Paraffin Wax	10
Thin Mineral Oil	88

Sticky Wax

Rosin	100
Talc	16
Lanolin	60
Paraffi	8
Sapon. Wax	2

Melt together and while stirring rapidly add slowly a boiling caustic soda solution (10° Bé.) stir until uniform.

Adhesive for Wigs

Damar	20
Rosin	20
Beeswax	40
Venice Turpentine	20

Heat to 90° C. and stir until uniform; cast in sticks.

* Adhesive, Wood

Casein	23
Hydrated Lime	4
Pot. Chlorate	1.5
Sod. Fluoride	1.5
Soda Ash	1.9
Borax	4
Alum	1
Titanic Anhydride	1

This will not combine with tannins and oils present in wood.

* Adhesive, Wood Veneer

Pot. Dichromate	0.25–2.0%
Slaked Lime	1–1.5%
Tapioca or Cassava flour	balance

Mix with water for use.

Waterproof Adhesive for Wood

Light gasoline	0.5 gal.
Acetone	0.5 gal.
Soft cumarone	10.0 lb.
Pine oil	0.5 lb.
Tricresyl phosphate	0.25 lb.

Adhesive for Fixing Wood, Tin, etc. to Celluloid

Shellac	2 gm.
Spirits of Camphor	3 gm.
Alcohol	4 cc.

Warm together until dissolved.

* Adhesive, Water-Resistant

Peanut Meal	100 lb.
Hydrated Lime	16 lb.
Soda Ash	10 lb.
Sod. Silicate	30 lb.
Copper Sulfate	2 lb.
Water	400 lb.

The above is used in glueing wood.

Casein, "Dissolving"

3 to 4 parts of cold water by weight to each pound of dry Casein.
1 ounce 26° Ammonia to each pound of dry Casein.
If a heavy solution is required, use 3 to 1 proportion; if a thinner solution is desirable, use 4 to 1.

Pour water into a jacketed kettle, or a kettle heated by live steam, and add the Casein. Stir well to break down any lumps that may form and then add Ammonia. Stir the mixture after adding the Ammonia and immediately turn on the heat. Heat, while stirring, to about 160° F. Turn off the heat when this temperature is reached and continue to stir, preferably with a mechanical agitator, until the Casein is completely dissolved, which will take about half an hour.

If the temperature exceeds 160° during the heating, it is not serious, although it is advisable not to apply excessive heat, particularly when Ammonia is used, as there is a tendency to somewhat weaken the Casein and to darken it in color.

When the Casein is completely dissolved it may be diluted, if necessary, by the addition of warm water and used, as dissolved, either hot or cold, in the same manner as ordinary glue.

10 pounds Casein
1½ lb. Powdered Borax
40 to 60 pounds *cold* water

Stir cold for about 15 minutes or until the Casein commences to swell.

Then heat in a jacketed kettle for 40 to 60 minutes at a temperature not higher than 160° F. stirring constantly.

Ammonia 26° can be used in place of Borax.

To make a thin solution we suggest using equal parts of Ammonia 26° and Trisodium Phosphate or Borax and Trisodium Phosphate.

If a preservative is desired you can use about 2% of Benzoate of Soda or ¼ of 1% Carbolic Acid.

Note—do not dissolve Casein in a copper kettle as this tends to discolor the Casein particularly if the solvent is Ammonia.

Cork and Wood Flour, Binders for

A. Rosin	100
Dibutyl Phthallate	35
Sod. Silicate	4
Nitrocellulose	4
Castor Oil	2

B. Ester Gum	50
Cumarone Resin	50
Linseed Oil bodied	10
Dibutyl tartrate	35
C. Urea formaldehyde resin	50
Cumarone Resin	25
Rosin	25
Tricresyl phosphate	20
Dibutyl phthallate	20

* Binder, Oilproof and Waterproof

Lead Oxide	59.6
Iron Powder	2.0
Portland Cement	18.2
Slaked Lime	5.8
Glycerol	8.2
Water	6.2

This sets quickly and is resistant to shock.

* Cement, Acid Proof

SiO_2 powder ground from grains of good strength and of sufficient purity not to be attacked by acids is mixed with a hardening agent, *e.g.*, $NaBF_4$ or Na_2SiF_6, and a solution of Na silicate in which the SiO_2/Na_2O ratio is $< 3.5:1$. Graphite may be added as a lubricant.

Aquarium Cement

To 10 lbs. of glazier's putty add 1 lb. dry litharge, 1 lb. dry red lead, and 1 gill of asphaltum. Mix to a stiff consistency with boiled linseed oil and add sufficient lampblack to give a slate color.

Another well-known formula consists of 10 parts by bulk of plaster of Paris, 10 of fine sand, 10 of litharge, 1 part of powdered rosin, and sufficient boiled linseed oil to make a stiff putty. A third formula is as follows: Red lead 8 parts, litharge 7, fine sand 10, powdered rosin 1 part, and spar varnish sufficient to make a stiff cement.

In each case add the linseed oil or varnish little by little and mix the ingredients very thoroughly. If the putty should become too soft, merely add more of the dry materials as the exact proportions are not especially important.

Adhesive Cement (For Fine Furniture)

Casein (fine ground)	12 lb.
Lime (powdered, unslaked)	13 lb.
Mica (dry, ground)	15 lb.
Barium sulphate (barytes)	60 lb.

Mix all ingredients. Keep in dry container. To use, mix with water until pasty. Hardens in about 24 hours.

Bituminous Cement

A mixt. of asphalt 660, asbestos fiber 60, pulverized soapstone 100, infusorial earth 80 and sand 300 lb. is used with a softening agent formed from a mixt. of (*a*) asphalt 48.8 lb., "turpentine substitute" 2.9 gal. and coal oil 10.7 gal. and (*b*) paraffin wax 73.1, Al stearate 3.6 lb. and coal oil 9.7 gal. The product is suitable for sealing pipes and conduits.

* Cement, Dental

Zinc Oxyphosfate	3
Tin C. P.	1

* Glass Cement

Chlorinated Naphthalene	10 lb.
Ester Gum	10 lb.
Rubber Latex	1 lb.

Melt together and apply hot. This may also be used for uniting metals, wood, etc.

Cement, Safety Glass

Pyroxylin	12
Camphor	2
Ethyl Methyl Ketone	30
Alcohol	15
Gum Benzoin	2
Triacetin	5
Benzyl Alcohol	2.5

Waterproof Glass and Metal Cement

This cement will also stand fairly high temperatures.

Cement and litharge in equal parts are thoroughly mixed. Then glycerine in an amount equal in volume to half the volume of the mixed powder is added and the whole thoroughly mixed with a spatula. This cement will set under water.

To repair leaks in pipes, fill the hole with the cement and bind it in place with cheese cloth. Then daub a quantity of the cement on the cloth and wrap the whole tightly together with iron wire.

The powders may be mixed ready for use, but the glycerine must only be added as needed.

* Iron Cement

Ground birch charcoal	4
Am. Chloride	0.5
Rye flour	1
Soda Ash	1
Sod. Nitrate	0.25

Iron Cement (for castings)

Iron filings	128 lb.
Plaster of Paris	20 lb.
Whiting	8 lb.
Gum Arabic	8 lb.
Carbon Black	1 lb.
Portland Cement	4 lb.

Make into a paste with water directly before using.

Linoleum Cement

Clay	20
Red Oxide of Iron	20
Dextrin	60

The powders are thoroughly mixed and made into a paste of desired consistency with water.

* Cement, Linoleum and Tile

1. Sicapon	82
2. Paraffin	9
3 Glycerin	9

Heat 1 and 3 to 80° C. and add 2 which has been melted to it slowly with vigorous stirring until emulsified.

* Cement, Linoleum Backing

A satd. felt base is coated an alkyd resin paint which may be by heating together at 150–180° ethylene glycol 35, diethylene glycol 3.5–7.5, glycerol 8–13, phthalic anhydride 105 and drying oil acids 80 parts and dissolving the product in ethylene glycol monoethyl ether or similar low-boiling solvents.

* Cement, Oxychloride

Fused Calcium Chloride	111
Magnesium Sulfate	120
Calcined Magnesite	250
Casein	10
Water	204

* Cement, Pipe Thread

Graphite	55%
Sicapon	45%

To the above paste may be worked in amounts of oils or water to obtain a lubricating effect. This paste hardens under heat to seal joints effectively.

* Lute, Chlorine Resistant

Burnt Clay (finely ground)	65
Caustic Soda 40° Bé.	35

* Pipe Cement, Plastic

Asphalt	24–28
Tung Oil	4–8
Asbestos Fibres	40–48
Petroleum Naphtha	20–24

Rubber Cement (For Use on Leather Shoes)

Naphtha (62° Bé.)	9.8 pt.
Carbon Tetrachloride	5.4 lb.
Crepe Rubber	0.33 lb.

Makes 1 gal. cement on allowing to swell.

Raincoat Rubber Cement

Hevea Rubber	50
Litharge	20
Whiting	26.5
Rosin	2
Sulfur	1.5

Grind and mix thoroughly.

* Cement, Rubber to Metal

Crepe Rubber	68 lb.
Benzol	6800 lb.
Bromine	40–80 lb.

Allow to stand and shake slowly until uniform.

Cement, Rubber Tire

Crude Rubber	2 lb.
Rosin	2 lb.
Carbon Bisulfide	1 gal.

* Cement for Repairing Shoes

Portland Cement	10 lb.
Rubber	10 lb.
Rosin	1.5 lb.
Shellac	2 lb.
Sole Leather Scrap	6 oz.
Benzine	1 qt.

* Pipe Joint Compound

The following compound contains no poisonous materials and may be prepared in dry form which will keep indefinitely. It forms perfectly leak proof joints when applied as a paste by mixing with water.

Flour	66
Portland Cement	25
Talc	3
Lamp Black	3
Sea Sand	3

* Filler, Expansion Joint

Cottonseed Oil	16
Rosin	4
Diglycol Oleate	1

Melt the above and add

Sulfur	8
Silica Dust	4

Continue heating and stirring until thick.

Floor Crack Filler

Plaster of Paris	32 lb.
Silica	200 lb.
Dextrine Yellow	33 lb.

Make into a stiff dough with water before use.

Glue

Blood albumin (90 per cent solubility)	100 parts
Water	170 parts
Ammonium hydroxide (specific gravity 0.90)	4 parts
Hydrated lime	3 parts
Water	10 parts

Pour the larger amount of water over the blood albumin and allow the mixture to stand undisturbed for an hour or two. Stir the soaked albumin until it is in solution and then add the ammonia while the mixture is being stirred slowly. Slow stirring is necessary to prevent foamy glue. Combine the smaller amount of water and the hydrated lime to form milk of lime. Add the milk of lime, and continue to agitate the mixture for a few minutes. Care should be exercised in the use of the lime, inasmuch as a small excess will cause the mixture to thicken and become a jellylike mass. The glue should be of moderate consistency when mixed and should remain suitable for use for several hours. The exact proportions of albumin and water may be varied as required to produce a glue of greater or less consistency or to suit an albumin of different solubility from that specified.

Blood albumin (90 per cent solubility)	100 parts
Water	140–200 parts
Ammonium hydroxide (specific gravity, 0.90)	5½ parts
Paraformaldehyde	15 parts

The blood albumin is covered with the water and the mixture is allowed to stand for an hour or two, then stirred slowly. The ammonium hydroxide is next added with more stirring. Then the paraformaldehyde is sifted in, and the mixture is stirred constantly at a fairly high speed. Paraformaldehyde should not be poured in so rapidly as to form lumps nor so slowly that the mixture will thicken and coagulate before the required amount has been added.

The mixture thickens considerably and usually reaches a consistency where stirring is difficult or impossible. However, the thickened mass will become fluid again in a short time at ordinary temperatures and will return to a good working consistency in about an hour. It will remain in this condition for 6 or 8 hours, but when the liquid finally sets and dries, as in a glue joint, it forms a hard and insoluble film.

This glue may be used in either hot or cold presses. When cold pressed, however, it has only moderate strength, and for that reason is not to be depended upon in aircraft construction where maximum strength is required. If hot pressed, it is high in strength and very water resistant.

Flexible Bindery Glue

Glue No. 1	123 lb.
Glycerin	90 lb.
Water	123 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

Extra Flexible Bindery Glue

Glue No. 2	75 lb.
Glue No. 3	75 lb.
Glycerin	64 lb.
Water	144 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

Flexible Machine Bindery Glue

Glue No. 3	150 lb.
Glycerin	105 lb.
Water	135 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

Regular Bindery Glue

Glue No. 1	175 lb.
Glycerin	10 lb.
Water	175 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

Tablet Binding Glue

Glue No. 1	126 lb.
Glycerin	113 lb.
Water	113 lb.
Zinc Oxide	5 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

Glue for Cellophane

17½ parts gum arabic
52½ parts water
30 parts Glycerine
.05 part Formaldehyde

* Casein Glue, Water Resistant

Casein	39
Peanut Meal	39
Hydrated Lime	11
Trisodium Phosfate	4
Sodium Fluoride	7
Water	225–235

Add the solids slowly to the water while stirring with an efficient stirrer. Continue until smooth and free from lumps. Allow to stand 20–30 minutes and add a mixture of aldol ½, water 1, and 50% copper nitrate 2. Stir for 5 minutes when it is ready for use.

"Dissolving" Glue

In a 100 gal. steam jacketted kettle place 80 gal. water; to this add 100 lbs. glue and soak for one hour; turn on steam and cook glue until dissolved; do not heat above 110° F.

Cabinet Makers' Glue

Glue No. 2	87½ lb.
Glue No. 3	87½ lb.
Glycerin	10 lb.
Water	175 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

In the above formulae the glue is soaked in cold water over night and heated not over 150° F. and stirred until dissolved. The other ingredients are then dissolved in it and the liquid is then poured into molds where it sets on cooling.

Case Making Machine Glue

Glue No. 2	175 lb.
Glycerin	10 lb.
Water	175 lb.
Betanaphthol	½ lb.
Terpineol	½ lb.

Furniture Glue

Animal glue	10 lb.
Powd. white lead	2½ lb.
Powdered Chalk	5 oz.
Sodium salicylate	2 lb.
Wood alcohol	1¼ pt.
Water	19 lb.

Dissolve sodium salicylate in water. Dissolve animal glue in the same water. Mix lead and chalk; add to the sodium salicylate water and glue. Add wood alcohol to the batch.

Leather Sole Glue

Rosin	60
Crepe Rubber	40
Varnish	30

Digest on a water-bath and when dissolved cool and add

Naphtha	30

* Liquid Glue

Sod. Chlorate	3.5 lb.

is stirred into a hot solution of

Glue	10 lb.
Water	18 lb.

Liquid Glue

Borax	2
Water (Boiling)	4
Pot. Carbonate	1

Stir the above into

Glue	16
Water (Boiling)	32

Masking Tape Glue

Glue (compatible with Calcium Chloride)	50
Water	35

Allow to swell for 3–4 hrs. Heat to 160° F. and then add while stirring

Glycol Bori-Borate	8
Glycerin	7

followed by

Calcium Chloride	0.35
Water	2

Care must be taken that temperature is kept below 170° C.

* Glue, Vegetable

Soya Bean Flour	100 lb.
Slaked Lime	10–20 lb.
Caustic Soda	5 lb.
Water	100 or more lb.

Mucilage

To 30 gallons water add 75 lbs. gum arabic, clean sorts. Mix at 160° F. until completely dissolved; add 6 lbs. carbolic acid, 1 lb. oil of cloves. Strain and fill.

Envelope Mucilage

Gum arabic	1 part
Starch	1 part
Sugar	4 parts

Water, sufficient to produce the desired consistency.

The gum arabic is first dissolved in water, the sugar added, then the starch, breaking up all lumps, after which the mixture is boiled for a few minutes in order to dissolve the starch, after which

it is thinned down to the desired consistency with more water.

Mounting Paste

White dextrine	1	lb.
Gum arabic	1	oz.
Water	1½	pt.
Acetic acid	1	oz.
Oil of wintergreen	20	drops
Oil of cinnamon	20	drops
Salicylic acid	20	gr.

The dextrine and the gum, which should be pulverized, are dissolved in the water, and then the salicylic acid added and dissolved. This liquid is heated with the dextrine, and when the whole has become pasty, which should require a quarter of an hour, the acetic acid is added, stirring in slowly. The heating is continued, taking care not to boil the mass. The paste will soon become pearly, and should then be removed from the fire and the perfume oils added while it is cooling. It should be stirred thoroughly while the oils are being added.

Mucilage, Stick Form

Powdered white glue	10 parts
Powdered gum arabic	2 parts
Sugar	5 parts
Water	Sufficient

Mix the glue and gum, then stir in enough cold water to make the solution the consistency of thick syrup. Soak overnight to allow the glue and gum to absorb the water, then add enough water to again bring it to a thick syrup. Pour into a flat bottom pan that has been chilled and cut into sticks of desired size when almost solid. If poured into molds the molds should first be well greased and then chilled by setting upon cracked ice.

The addition of 0.1% of Moldex in the water used will prevent spoilage.

Decorators' Paste

	Pints by Weight
Rye meal	4
Fine whiting	2
Casein	1
Powdered alum	½

Mix the above ingredients together and rub to a fine powder. Use 2 lb. of the mixture to one quart of water either hot or cold.

Flour Paste

Wheat Flour	4 lb.
Cold Water	2 qt.
Boiling Water	3 gal.

Make smooth paste of flour and cold water and then pour into boiling water. Stir and boil for 5 minutes

Library Paste

1.

Tragacanth (powdered)	20
White Dextrin	10
Wheat Flour	60
Glycerin	10
Cold Water	40
Salicylic Acid	3
Boiling Water	400

Mix the tragacanth with 160 parts of boiling water, stir well and set aside. Mix the dextrin and the flour with the cold water, stir well and add to the tragacanth mucilage. Pour into the resulting mixture the rest of the boiling water stirring constantly. Rub up the salicylic acid with the glycerin, add to the mucilage and boil for 5 to 6 minutes with constant stirring.

2.

White Dextrin	6 oz
Diluted Acetic Acid	1 oz.
Oil of Clove	10 drops
Glycerin	1 oz.
Water to make	16 fl.oz.

Make a paste of the dextrin with 6 ounces of cold water, add 8 ounces of boiling water, boil 5 minutes with constant stirring, then add enough hot water to make 14 fluid ounces. Let cool then add the other ingredients.

Library Paste

Flour	16
Gum Acacia	12
Gum Tragacanth	3
Salicylic Acid	0.5
Clovel	0.6
Water	160

Use part of water to make a paste of flour. Heat another part of water with gums until dispersed. Mix these two well and other ingredients and bring to a boil while stirring.

Library Paste—Photo Mounting

White Potato Dextrine	15 lb.
Water	15 lb.
Glycerin	1 lb. 15 oz.
Formaldehyde	2½ oz.
Oil of Sassafras	2½ oz.