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# Eastern Massachusetts



## Guild of Woodworkers

# Hide Glue in the Modern Wood Shop

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Jim Russell - EMGW Meeting - May 2016

## Get ready for some whiplash

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- Last month EMGW meeting on CNC machines covered
  - computer driven
  - high-tech
  - high cost
  - high volume woodworking technology
- This month EMGW meeting is on
  - hand driven
  - low tech
  - low cost
  - one off woodworking technology



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# Today's Discussion

- Hide glue
  - History
  - Properties
  - Uses and alterations
  - Preparation
  - Storage
- Demonstration
  - Rub Joints
  - Hammer Veneering
  - Veneer embellishments
  - Grain Filling



## Purpose of Discussion on Hide Glue

Why bother? My PVA works just fine.

Examine the **practical uses** and benefits of hide glue for woodworking today

- What problems it solves
- What functionalities it enables
- What flexibilities it offers
- What challenges it brings

Address some of the **myths** relating to Hide Glue

- It is messy
- It requires extensive preparation
- It requires expensive equipment to use
- The open time is way too short
- It is not as strong as PVA glue

# Where Did Hide Glue Go

- Still used today by luthiers, restorers, piano repairers, period furniture makers
- In the 50's PVA manufacturers advertised PVS as being
  - Stronger than Hide Glue (not true)
  - Waterproof - (true but so what)
- Before then Hide Glue was totally ubiquitous in a woodshop
  - Everyone knew how to use it
  - Everyone knew how to modify it
  - Most of woodworking knowledge passed by word of mouth
- 4 generations have passed and the knowledge about the unique uses has just disappeared from the woodworking vocabulary

# Blended Woodworking

- "Power Tool Only" advocate
  - Views hand tools as a throwback to an earlier era
  - Hand Tools are
    - not necessary or
    - involve too much preparation and training to be useful to them
- "Hand Tool Only" advocate
  - Views hand tools as the only pure way to accomplish woodworking tasks and make furniture
- Blended Tool User
  - Use the most effective tool
  - Use machines as an extension of the hand



# The Blended Woodworker

Woodworking

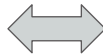
- Uses power tools to
  - take care of highly repetitive tasks
  - do a lot of the heavy lifting of milling and hogging out material for joints



- Uses hand tools to
  - accomplish one-off tasks
  - properly fit joints
  - prepare surfaces
  - make joints that cannot be cut with a machine.

Gluing

- Uses PVA
  - Non furniture projects
  - Projects to be painted
  - Jigs



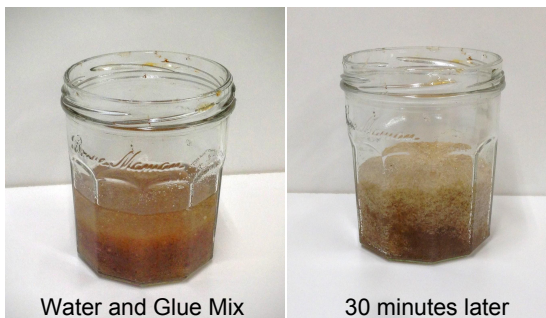
- Uses Hide Glue
  - For furniture joints
  - Veneering
  - Rub joints
  - Filling and finishing
  - Extreme open time

## Hide Glue - An Extraordinary Woodworking Glue

- Provides glue joints that last for centuries
- Is extremely strong
- Has properties that are easily modified to satisfy a variety of woodworking needs
- Is easily reversible
- Has unlimited shelf life
- Will be open for 1 minute
- Will be open for 30 minutes
- Will stick to itself
- Will gel in one minute (initial tack)
- Will never gel
- Allows you to glue up without clamps
- allows you to glue up with clamps
- Allows you to veneer without a vacuum press or a mechanical press
- Is absolutely rigid when dry and will not creep
- Is absolutely flexible when dry and will move with the wood
- Will not impact the finish
- Can be used as a filler
- Is non-toxic

## Mixing Hide Glue

- Mix the appropriate amount of water with dry hide glue using the chart on the right
- Allow the water to be absorbed for at least 30 minutes
- Heat the mixture in a double boiler
- Adjust the viscosity as required.



Typical Water to Glue Ratios by Weight

Glue Grade (Test in Grams)	Porous Woods (Weight, Water to Glue)	Non-Porous Woods (Weight, Water to Glue)	
379	3 – 1	3 ¼ – 1	
347	2 ¾ – 1	3 – 1	
315	2 ½ – 1	2 ¾ – 1	
283	2 ¼ – 1	2 ½ – 1	
251	2 ¼ – 1	2 ½ – 1	General Woodworking
222	2 – 1	2 ¼ – 1	
192	1 ¾ – 1	2 – 1	General Woodworking
164	1 ½ – 1	1 ¾ – 1	
135	1 ¼ – 1	1 ½ – 1	

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## Practical Mixing

- Hide glue mixing formulas are by weight
- Glue varies from batch to batch. Testing is a good idea.
- Once a satisfactory mixture is achieved, note the relative volumes and mix future batches using approximate volumes
- My formula for 192 Gram Strength
  - Put about an inch of glue in a jar
  - Add enough water to cover by ½ inch



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# Modifying the Properties

Hide glue is easily modified to take on new properties

- Change open time
- Increase adhesion
- Make flexible

Additive	Purpose	Comments
Salt or Urea	Extend Open Time	Add 15% urea or table salt by weight. Will extend the working time of 251-grade glue from 1 minute to 5 minutes
White Vinegar	Improve Adhesion	Replace 5% of the water by weight with white vinegar
Glycerin	Flexible	Add 5% to 15% glycerin by weight. Softer glue will accommodate wood movement - good for situation such as applying the bonnet board to the top of a highboy or gluing tambours.

# Filling and Sizing

- Watery mix of water to hide glue of about 9:1 brushed on
- Grain is raised and the glue fills wood
- On sanding, a glasslike surface is obtained
  - Stable against moisture changes
  - Takes a lasting final stain or finish

# Liquid Hide Glue

Liquid Hide Glue is Hide glue formulated to:

- Stay liquid at room temperatures (no glue pot required)
- Have an open time of up to 30 minutes
- Not gel

# Strength of Liquid Hide Glue

- Throughout the web searches there are multiple **anecdotal** references to the fact that the additives used to make **liquid hide glue** result in a **weaker** glue
- A Study of The Properties of Commercial Liquid Hide Glue and Traditional Hot Hide Glue in Response to Changes in Relative Humidity and Temperature by Susan L. Buck, Art Conservation Fellow, The University of Delaware/Winterthur Program in Art Conservation
  - The most critical factor in the strength and stability of the 20 liquid hide glue and 20 hot hide glue joins was the environment.
  - **Based purely on strength** characteristics this testing indicates that **liquid hide glue is the glue of choice** for repairing a join which will undergo significant stress, such as the structural join of a chair in regular use.
- **Conclusion: Bloggers make stuff up and other bloggers repeat it**

# Commercial Liquid Hide Glues

- Commercial liquid hide glues
  - Titebond, Franklin, Old Brown Glue
- Titebond and Franklin have been formulated to retain the viscosity of yellow glue at room temperature.
- Old Brown Glue benefits from being warmed and kept in tepid water. This is particularly true if the shop is cold.

# Shop Made Liquid Hide Glue

- The formula provided by the Animal Glue Industry is:
  - 10 parts by weight 285 g test animal glue
  - 20 parts by weight water
  - 2 parts by weight gel suppressant (specific references made to thiourea)
- I don't have any thiourea
- I use 192 g test glue (changes water to glue ratio)
- When substituting salt or urea, this formula results in an extremely viscous mass

# My Secret Liquid Hide Glue Formula



Mixture ratios by **weight**

Glue Strength	Water	Glue	Salt or Urea
192	16	10	3

Mixture ratios by **volume** to produce about 5.5 ounces of Liquid Hide Glue

Glue Strength	Water TBS	Glue TBS	Salt or Urea TBS)
192	6	5	2

Weight to Volume Conversion Table

	Ounces / TBS	Grams / TBS
Water	0.50	14.2
Glue	0.40	11.3
Urea	0.33	9.2
Salt (table)	0.64	18.1

- Liquid hide glue will possess a viscosity that will slowly decrease with time
- Urea formulas lose viscosity at a slower rate.
- Refrigeration is very helpful to extend shelf life
- This formulation needs to be warmed slightly for best results

## Testing Hide Glue



2 tablespoons in 1 pint of water

Let sit 12 hours

Pour off surface water and weigh glue mass

5 times the original weight or more is excellent

Solidity of the mass indicates the strength

# Setup for Making and Using Hide Glue

Myth - high cost of equipment needed to make and use hide glue



The \$130 solution



The \$20 solution

## What do you need to make hide glue

- Heat source that can be regulated to a specific temperature
- Container for the water
- Container for the glue
- Some means of suspending the glue container in the water
- Thermometer



Regulated heat source



Water Container



Suspension System



The \$20 Solution

# Using Hide Glue

## Myth: Inconvenience of Hot Hide Glue

- Hot hide glue will go bad within a few days
- Whatever glue is not used will go bad and be wasted
- Few woodworkers want to consume valuable shop time preparing and cooking glue

## Solution

- Refrigerate it - works for a month or more
- Freeze it - works for a really, really long time

# Storing Hot Hide Glue

- Refrigerate Hide Glue
  - Put the jar with the unused glue in the refrigerator.
  - Refrigeration extends the life of the product.
  - I have stored prepared glue like this for well over a month.
- Use Refrigerated Hide Glue
  - When hot hide glue is needed, just take the jar out of the refrigerator, place it in the glue pot and turn it on.
  - In a few minutes, everything is up to temperature and ready to go.
  - Any unused glue can be put back in the refrigerator.

Some people recommend using a microwave to reheat glue. All my efforts in this area have not been successful. I find the glue pot to be quick and predictable.

# Storing Hot Hide Glue

- Freeze Hide Glue
  - Glue can be stored for extended periods
  - Allow the glue to cool to room temperature
  - Cut the “solid” glue into 1” size cubes with a knife
  - place the cubes in a plastic bag and freeze them
  - Don’t put the jar in the freezer
- Use Frozen Hide Glue
  - Take out the number of cubes desired and heat them up
  - For small amounts, a “cube” can be floated in the hot water in a small plastic container
  - This is a particularly useful approach if only need small amounts of glue are needed for something like doing inlays.

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## Practical Applications

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- Furniture joints
- Rub joints
- Wood filler (mix with sawdust)
- Grain filler
- Hammer Veneering
- Press Veneering
- Tambours
- Biscuit Joinery



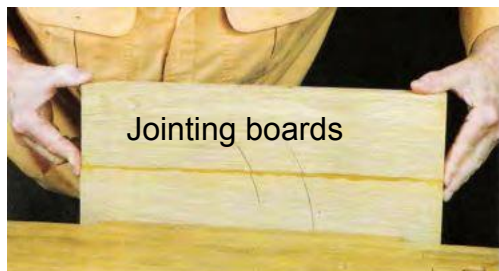
308 Catalogue Entries

# Rub Joint

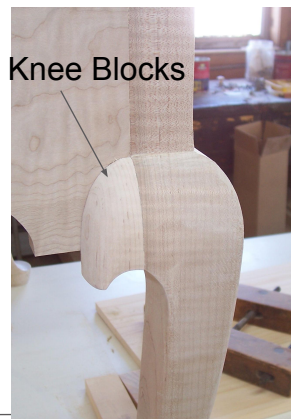
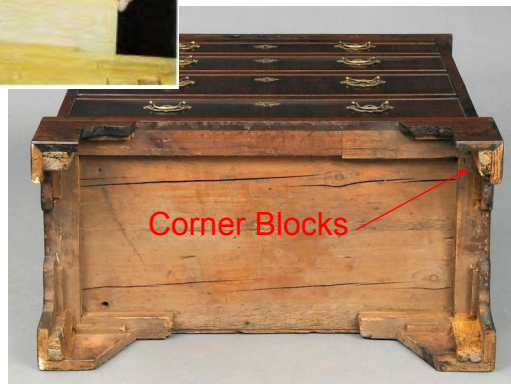
Method used by Ian Kirby - described in December 2007 Woodworker's Journal

- Hot glue is applied to completely wet both edges
- With one board in the vise, the second is positioned and rubbed back and forth a few inches while bearing down on it with as much force as possible to squeeze out the glue
- As cooling and gelling took place, rubbing becomes more difficult, and squeeze out reduces
- Before the glue gels, the top board is accurately positioned side-to-side and end to-end with the bottom board
- The jointed board can be released from the vise and put on the floor resting upright against the wall on a support stick
- No clamps required

# Where to use Rub Joints Today



Use a rub joint anywhere it is hard or inconvenient to use a clamp



## Grain Filler

- Hide glue is an excellent and economical alternative to modern grain fillers
- The Animal Glue Industry book guidance is:
  - One pound of glue per gallon of water is applied to the wood surface and let dry.
  - Grain is raised and the glue fills porous exposed wood structure
  - On sanding, a glasslike surface is obtained, which is stable against moisture changes in which takes a lasting final stain or finish.
- My process for grain filling with hide glue and finishing
  - Cut some hot hide glue with water to triple the volume
  - Brush in the watered down mixture
  - Allow to dry. Scrape and sand as desired
  - Repeat if necessary
  - Apply two coats of dewaxed shellac (I like shellac but any topcoat will work)
  - Rub with #0000 Steel Wool and wax
- Don't use this process to fill veneer put down with hide glue
  - To fill veneer, lay it down using hot hide glue on top of the veneer (rather than water) as a lubricant and don't rub it off - rub it in
  - Scrape and sand after it is dry

# Application of Veneers



Card Table - John and Thomas Seymour, 1800

# Hammer Veneering Equipment

- Veneer Hammer
- Knife or veneer saw
- Straight edge guide
- Iron
- Warm water and rags



# Hammer Veneering Process

- Coat the substrate with thin glue
- Dampen the outer surface of the veneer with hot water to prevent it from curling
- Lay veneer on the glued surface smoothing it out from the center to exclude air
- Heat a section with the iron moving it constantly to prevent the iron from sticking
- Squeeze the glue out towards the edges with overlapping strokes
- Each section must be cooled and bonded before moving on to the next section

# Jointing Veneers

If multiple sheets need to be joined to complete the surface

- Lay down one sheet completely
- Lay down a second sheet overlapping the first sheet by about 1 inch
- Cut through both sheets through the centerline of the overlap
- Remove the overlap cutoffs – and more glue if necessary
- Hammer down the join
- Tape the joint if necessary

Using this process makes makes it easy to veneer substrates of any size.

“With hammer-veneering you could veneer the whole world if you wanted to.” - Tage Frid

# To Tooth or not to Tooth

- A significant proportion of woodworking blogs that talk about hide glue / hammer veneering say that toothing is required and claim
  - Improves the grip
  - Improves the glue surface
  - Period makers toothed their veneers and substrate for hammering
- The facts
  - Period woodworkers toothed just about everything to get it leveled out - including their hand sawn veneers
  - Until the early 1900, it was believed that hide glue made a mechanical bond and that toothing helped improve the bond
  - Hide glue makes a chemical bond that is not improved by toothing



# Veneer Softener



Formula recommended by Phil Lowe

- 1 Pint of Water
- 1 Pint of Alcohol
- 4 Tablespoons of Glycerin
- 2 Tablespoons of Hide Glue

How to use it

- Spray on the veneer and completely soak
- Allow the excess to drip off
- Place between pieces of newsprint and press between flat boards
- Change paper every few hours until the paper stays dry
- Use the veneer or keep it between flat boards

# Wood Filler - Repair small defects

- Place a small amount of hot hide glue in a small plastic container and float it in the water bath
- Make a supply sawdust with a dull scraper or use some collected earlier in the project.
  - Consider using a lighter wood as the mixture with the glue will be dark
- Add the sawdust to the hide glue and make a thick paste
- Fill the defect with the paste
- After it dries, add more if the defect is not filled (repeat until filled)
- Sand or scrape to blend with the surface

For more information about gap filling see "***Some Experiences with Flexible Gap-Filling Adhesives for the Conservation of Wood Objects***" by Don Williams - Proceedings from the symposium "*Facing the Challenges of Panel Paintings Conservation*" organized by the Getty Conservation Institute