Glues, Adhesives & Other "Stickers"

Bill Smith

There are many brands of glues available for use in piano repair and general woodworking. Some of these glues have been on the market only a few years, but have been the choice of many piano repair people.

1. **White PVA Glue,** like "Elmers," has longer "open time" for assembly. It is easy to use, non-toxic, and easy to clean up. Use for adhesion where little stress is a factor. It is slightly elastic. This is the original white glue, although it has been improved since it first came out. The early glue smelled sour, kind of like buttermilk. It used to be made with milk and vinegar. The current ingredients are proprietary.

2. **Yellow PVA Glue,** like "Franklin Titebond" or "Elmers Carpenter Glue," sets up a bit more quickly than the "white glues." Under some conditions this is somewhat elastic. It cleans up with water. "Titebond II" is a water-resistant non-toxic glue. If left out in the weather, the glue softens slightly but the glue joint stays intact. Titebond II will stain your hands.

3. **Liquid Hide Glue** is a hide glue that does not have to be heated or mixed. This allows long assembly time. It cleans up with water, which is a big plus. Parts can be disassembled if needed. Cold hid glue is just hot hide glue with urea in it. Mix titanium dioxide with cold hide glue to color it in order to match the color of an ivory. The hide glues are the only ones that will adhere to themselves. This is cohesion. Put a layer of titanium dioxide mixed with cold hide glue on the key front with your finger and let it set up for about twenty minutes. Since super glue is also attracted to moisture and water acts like an accelerator with super glue, then glue the ivory to the white surface with super glue. Cold hide glue has a short life. Since it is the least popular glue, it might have sat on the shelf for a while before you even get it.

4. **Hot Hide Glue** was always the most used glue until fairly recent times. "Hot Hide" is a brittle glue. It is a chemical bond that dries hard. A disadvantage might be dealing with the glue pot routine. It is easy to clean up with water. Working time is rather short, since it sets up quickly. You can increase the working time by adding urea to it. In the dry Egyptian tombs and in ancient China hot hide glue was used. They processed animal urine. Nowadays they process the urea. Plain table salt – sodium chloride – can also work, it neutralizes the glue and won't corrode if it comes in contact with metal. Put alum in hot hide glue and it will become so hard you can't get it out. Hot hide glue is an edible product and is made out of animal hide. To make the glue, they take the hide and distill it & dry it. Jello is made from pork hides and is made the same way. To speed up hot hide glue, add Knox gelatin with it. Ivory wafers are made with hot hide glue. Hot hide glue is one of the original glue that all other glues came from. Hot hide glue used to be made to etch glass. All the cathedral windows were colored with chemicals, but were etched with hot hide glue. Nowadays hide glue is still used in particleboard and plywood.

5. **Weldwood Plastic Resin** has some of the properties of "Hot Hide Glue" in that it sets up hard and brittle. It's a water mix, but becomes resistant to moisture and solvents after cure. During work time it can be cleaned up with **water**. Once set it is impervious to water.

6. **Contact Cement** is great for cementing rubber to wood, and for leather to wood or metal. Contact Cement is not good for stress situations if shear or creeping is a factor. Don't breather the fumes because they are toxic. Use adequate ventilation.

7. **Gorilla Glue** is a polyurethane glue that has come into use fairly recently. It has good working time, and foams during cure. Clean up with water or alcohol. It takes a little getting used to, but it gives a good bond and is water resistant. Bill showed us a bottle of Gorilla Glue that had been left open; it foamed and bubbled out the top & down the sides.

8. **Cyanoacrilate** is what "Super Glues" are. These glues are good for quick repairs. They are toxic and the fumes are very irritating to the eyes and breathing. Use good ventilation. Caution: avoid getting excess glue on fingers and skin, and especially eyes. Squirt in stripped screw holes. A scientist at Eastman Kodak discovered the formula over 62 years ago. The company shelved the idea because it was too sticky. The gel has more working time than the thin super glue. The thin glue penetrates pores more thoroughly than the gel.

9. **Epoxy** can be used where tight joints are not possible or where some of the part is shattered or missing and a space filler is needed. It can be used for attaching metal to wood or metal to metal. Clean-up can be messy.

10. **Barge Cement** has been used in shoe repair shops for many years and is great for gluing leather to leather, leather to wood, leather to metal, metal to metal, and for rubber to almost any material. You need naptha for clean-up. Use ventilation because the vapors are toxic. Apply to both surfaces. Use pressure or clamping.

11. **Arlene's Tacky Glue** is a water base, is cleanable by water, but once set is waterproof. It does not soak into felt.

12. **Titebond Sanding Disk Cement** is kind of like contact cement. It can be peeled off.

Experiments

- Bill glued wood strips to a curved surface and watched the arch relax over time.
- Bill used Super Glue gel to glue over 2700 ivory tails together and then carved them into an ivory tusk. The fumes from this job effected his eyes for over three months. One day he accidentally glued one hand to the tusk and the fingers together on his other hand, with the acetone about 4' away.
- He made a block of ivory using 704 tails and thin super glue.
- He glued blocks of wood together and left them out in the weather for several years. Each pair of blocks was glued with a different type of glue to compare how the glues held up.
- Using jar lids mounted on a board, he filled each metal lid with a different kind of glue and let them harden.
- To etch glass with hot hide glue is about a 4-day process. Start out with a jar, like a salsa jar. First rough it up with some diamond paper. Ideally, sandblast it. Rub it on concrete or whatever to rough the glass up. Add a lot of alum to the hot hide glue. Take a paintbrush and brush it on. Let it gel for about a half an hour and put on another coat. Let it sit overnight and it will start to set up. The next day put it in a box under a hot light. You will hear a popping sound like microwave popcorn. What is happening is that the glue is starting to pull the glass off the surface. First you'll see the glue flaking off the glass. This also works on plate glass, and better on new than old glass. Some people say you can get the same effect on wood.
- We tried to break apart some glued pieces of wood by tightening a C-clamp on the ends.
- Bill took two strips of flexible ¼" wood, applied glue and then clamped them together and twisted them 180 degrees. After 48 hours it relaxed at least 20 degrees. He tried this with various glues.

Removing Glue

- Steam with a wet cloth
- Machine off
- Titebond is difficult to remove. Heat will slightly loosen it up. Elmers gets stretchy.
- Alpha is a solvent that will remove anything, but it might not be available any more.

Tips for Good Gluing

By Jeannie Grassi and Bill Smith
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GLUES: Originally glues were made from natural ingredients, like paper, milk, animal hides, wheat, flour
ADHEWSIVES platics rosins

How much water is in each of the water-based blues?
Bill filled jam jar lids with a variety of glues and let them set up. They were all kept in the same room at the same temperature. Over time the glues did the following:

1 scum
2 wrinkle
3 cave in
4 harden

Then Bill painted pieces of cardboard with each of the glues to see what would happen.
Since only one side was coated,

HOT HIDE GLUE
Bill poured hot hide glue into a can and it started to shrink. You can use and reheat hot glue for about three days. After that it seems to weaken. Hot hide glue is a protein, made from hides, bones or sinews of a bovine animal. It comes in the form of beads, flakes, or granules. There are different qualities of hide glue. Milligan & Higgins, Garrett Wade, & other manufacturers. Each brand requires a different amount of water. Urea is not poison but is slightly toxic and can be found at garden places because it is used as a fertilizer. Urea formaldihyde is no longer used because of the toxic vapors. Alum will harden hot hide glue. Alum is used for making pickles. When you add alum to a pot of hide glue, it does strange things. About a half-teaspoon will make it thick and stringy. This is useful in etching glass. The technique to etch glass is to:

1. rough it up with sandpaper or a carbide tool
2. brush on the glue
3. let it sit for about an hour
4. put on a second coat
5. let it sit for about one day
6. put it in a cardboard box in the oven around 110 degrees

Gelatin added to hot hide glue will make it set faster.
Glycerine can be added to make it more flexible instead of making it dry hard and brittle.
The furniture joints made 2000 years ago were joined together with hot hide glue, and to this day the joints are just as strong, as long as they were not subjected to moisture.

Glue was one of the first things that humans started using.
Milk is one of the proteins that makes it set up.
If you ever go to Europe and look at the cathedrals, all the etched glass was etched with hot hide glue.
Old glass is more brittle than new glass and will etch deeper.

Uses:
Felt-to-felt, felt-to-wood, wood-to-wood.
The big advantage of hot hide glue is that it is reversible and can be undone.
For piano work it is important to know which types of glues are reversible and which are not.
Hid glue can weld to itself.
Add acetic acid and it will dissolve the glue. When it dries, it tightens up and holds.

Bill displayed a set of hammers, each of which was glued onto a shank with a different kind of glue.
Because hide glue is more brittle,

COLD HIDE GLUE
Bill used some 12-year-old cold hide glue to bond the sticks on his curved jig. It held for about six months and then gave out.

TITEBOND
The chalk point is the temperature that gives a workable time. When glue gets below the chalk point temperature, rather than setting up hard and solid, the glue will be chalky and flaky. Titebond III has a low chalk point and works better in colder temperatures.

PVA
Polyvinyl acetate and alephatic resin are the same thing.
When Elmer's first came out, piano technicians were reluctant to use it because it was a school glue. After a while, it was clear that there were many advantages:
Sticky quicker, better set-up time, easy clean-up, clear, non-toxic.
Bill left some sticks of wood on the patio to get rained on and to let the sun shine on them. He took some other sticks of wood and let them sit in water for 24 hours. He was surprised to find that Elmer's held.

Bill made up a curved jig for testing glues. He made a set of curved glued sticks and clamped them. Later he un-clamped them to see how much the glue relaxed. Spruce is hard to find.
The boards glued two years ago with contact cement is now almost completely straight, even though it's still glued together. It relaxed too much. This experiment shows that the glue holds the shape. The moisture has not effected it. It is the strength of the glue that holds it in position.

CONTACT CEMENT
There are solvent-based and non-toxic water-solvent-based.
Spray adhesives do not hold as well, and are unpredictable where the spray drifts.

PVCE
Sobo Glue, Weldbond, Universal Space Age Glue, and Tacky Glue are probably PVCE glues, but we are not sure. They all smell similar. Weldbond says that they are similar. Tacky Glue takes longer to dry because of the moisture content. Alcohol will dissolve PVCE glue.

DATES
Before buying glue, ask the store how old the glue is and how long it has been sitting on the shelf. When you buy your glue, date it.

GORILLA GLUE
Bill deliberately left some of the glue sticking out. He also wet one end and did not put glue there.
Within six iminutes it is too late to wipe up a mess. Moisture makes it dry quickly.

TWIST
Another experiment Bill did was to glue two pieces in a twist. He clamped one end and did a full half turn without putting any glue on. Then he smeared glue on both sides of the wood, clamped one end, twisted it a half a turn, clamped the other end, then clamped the clamp. Next he placed a series of small clamps all along the twist.

IVORIES
- CA glue is not very good. It doesn't stay. They pop off again, leaving a surface with PA glue which is hard to remove. It's hard to tint or color CA glue. Powdered titanium dioxide makes it gooier and thicker, which changes the height of the glue. There is an accelerator for CA glue, but it works too fast, it smokes, and it is toxic. Since CA glue reacts to moisture, rub a damp rag on the part and this will accelerate the activity. There are two forms of CA glue: liquid and gel. If your CA glue bottle is open and you spray something, that spray will go into the bottle. Warnings on the bottle: bad for air passages and eyes. It can cause permanent eye damage. You don't notice it, but it sneaks up on you.

- Epoxy with whitener is not easy to work with in someone's home because it is a mess and hard to clean up. It reacts with heat. It is very permanent.
- Ivory wafers is the old way. They used hide glue with a warm clamp. It is hard to figure out the level of the new piece. If you sand it to match the wafer, then wet the wood it compresses and things change.
- Sobo glue works and can be tinted. Mix Sobo glue, 1:1 with titanium dioxide, use as a coating to cover the wood, then use more to glue it on.
- Chris uses cold hide glue mixed with titanium dioxide.
- PVA on one surface and wet the other surface and clamp it.

HOT GLUE GUN STICKS
Quick repairs
Not strong or permanent
OK for felt to wood

REMOVING HAMMERS GLUED TO SHANKS WITH VARIOUS GLUES
Urea formaldeyde: broke the wood
Titebond III was the hardest
Yamaha factory shank was a clean removal.
Titebond I was easier than III
Super Glue (CA glue) was very hard to pop out, and most of the shank was still in the hammer.
Gorilla glue was easier than he thought it would be.
Epoxy left some of the hammer in the shank.
Duco cement looks awfully similar to the glue on the Yamaha factory hammer. It's kind of a clear milky color. Jeannie removed the hammer easily.

EXPANSION EXPERIMENT
Piece of plywood has 6 holes drilled in it. These holes are too big for a dowel.
Bill coated the hole with baking soda, inserted the dowel, then applied CA glue around the entry. Instantly the dowel was not able to be removed.
Jeannie asked what is in "Chair Lock" and how does it work?
CA glue can be used for filling cracks in bridges & tuning pins in a pin block. It works well if Garfield's has been previously applied.
Antifreeze used to be applied to tighten pins in pin blocks.