



Restoring Arcade and Pinball Games, Part One

by cfh@provide.net, 11/02/09.
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Scope.

This document is a restoration guide for coin operated arcade and pinball games. This information largely focuses on EM (Electro-Mechanical) games before 1978, but certainly applies to later coin operated games too. No experience is assumed. This document does not cover repair. If the game doesn't work, first see <http://marvin3m.com/fix.htm> and get it working. **This document is part one of three** (part two is [here](#) and part three is [here](#)).

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1a. Getting Started: Necessary Tools and Parts

Restoring EM pinball and arcade games will require a few tools. Luckily, most are not that specialized and are easy to get.

Tools Required:

- Work Light: clamp style lamp works well
- Screwdrivers: small and medium size, phillips and flat head
- Nut Drivers: 1/4", 5/16", 11/32"
- Wrenches: 9/16", 5/8" required, other sizes suggested
- Needle Nose Pliers
- Soldering iron. Home Base and Home Depot sell a decent Weller SP23 soldering iron for about \$12.
- 60/40 Solder. Only available at electronic stores and Radio Shack. Local hardware stores only sell 95/5 lead-free solder, which won't work here. Radio Shack's solder is Kester's, and is good quality.
- Right Angled Screwdriver: both phillips and flat head.
- Drill and Drill Bits
- Light bulb socket cleaner (a rubber pencil-like device)
- Switch contact adjuster
- Flexstone file
- [Buffer](#) (see that section for details)
- White Rouge stick polishing compound

- Novus #2 (for cleaning playfields and rubber)
- Novus #3 (optional, for cleaning metal parts)
- A paste Wax (Trewax) or Meguire's Carnauba Wax (for waxing playfields and cleaning rubber)
- Goo Gone (for removing old adhesive from stickers and removing Latex paint)
- Plastic paint scraper
- Razor blades
- Scotchbrite Green Pads
- Mean Green (cleaner)
- 409 Cleaner
- Sponge with backside green pad
- [Lightning Rust Remover](#)

You can get Novus at many places (my local grocery store sells it), or from any good pinball vendor. I don't recommend MillWax, but others like it (mostly because they have been around for a long time and are used to them). Don't buy any Wildcat products as they react with plastic. A good paste wax like Trewax or Meguire's Carnauba Wax you can get at Kmart or the local hardware store. For the lubricant, I like the Radio Shack Teflon grease. It has Teflon in it, dirt tries to slide right off and does not stick to the grease. It works great.

Typical Restoration Parts Used:

- Leg Levelers
- Plunger shooter spring (Gottlieb part #A-347)
- Lot of coil sleeves (mostly the short 1 21/32" length for Gottlieb, part #A-5064)
- White rubber rings, flipper rubber, and shooter tip
- Flipper links and plungers (game specific)
- #47 light bulbs, quantity 100. Do not use #44 bulbs as they burn too hot, and can accelerate backglass delamination.
- Pop Bumper light sockets, bayonet (#47) style, Gottlieb part #131
- Pop Bumper skirts in the correct color(s), Gottlieb part #A-1218 (specify color)
- Flipper shaft, new reissue part for Gottlieb, part #A-6888
- New Screws for small Gottlieb flippers, slot head, 6-32, 1.25" long
- Pop bumper rod and ring assembly, Gottlieb part #A-1316
- New Gottlieb coin door start button, part #A-4524
- Pop Bumper caps, if available
- Power cord with 3 prongs (or a 3 prong extension cord works too)
- Power switch (if game doesn't have one)

You can get all this stuff from one of the sources on the [suggested parts & repair sources](#) web page.

1b. Getting Started: Making a Buffer

To do restorations, you're going to need a buffer. To get metal parts glemming again, there isn't much choice. Buffing by hand is too time consuming.

Your buffer could be as simple as a drill with a small chuck mounted wheel (see picture below, one is laying on the table). This works, but is not optimal. I got a drill mounted wheel at the local production tool supply house for about \$5. It's 2" wide and 1" thick.

Another alternative is to use a bench grinder with 6" wheels. Remove one of the grinding wheels and replace it with two or three 6" by 1/2" sewed buffing wheels. Since bench grinders operate at such high speed, you'll also need a foot operated power switch. Again, you can get this at a local production tool supply house. This foot power switch will allow you to turn the power off and on easily and in spurts to limit RPM's.

I made a "real" buffer from a table and motor I got at a garage sale (see picture). The rest of the parts I purchases at a good hardware store. This included the metal rod (which I threaded on the ends with a 3/8"-16 die, available at a hardware store), the bushing blocks, the rod collars, the pully and belt, a couple washers and nuts. It works quite well.

The key to power buffing is the white rouge. It is fine enough to give a great shine, but will cut pretty well too. I got this product in stick form at the local production tool supply house.

Buffer: use sewed buffing wheels (loose and biased wheels don't work well). These are 8" diameter and 1/2" wide (shown mounted and unmounted). Also available in 6" and 10" versions. Can use 6" version on a bench grinder, but must use a foot power switch to manually limit RPM. Can also use a drill mounted 2" diameter by 1" wide buffer wheel (shown). Use white rouge buffing compound in stick form (shown).



Buffing Safety.

When you buff, do it safely! Keep this in mind:

- The buffer can RIP parts out of your hand, and throw them violently! Hold on to parts securely. Vice grips work well.
- Make sure the buffing wheel turns AWAY from you. This way, if the buffer does grab a part, it will throw it away from you, and not towards you.
- Parts getting buffed will get HOT.
- Wear leather gloves.
- Wear eye protection.
- Do not wear loose clothing that could get caught in the buffer.

1c. Getting Started: Vibration Parts Polisher & Rock Tumblers

How It All Started (Short Tumbling History).

Polishing parts to a high shine was an idea I basically stole from Tim Arnold. After visiting Tim in 1998, I noticed a lot of his parts had a high shine to them. He showed me his buffing wheel, which was basically a grinding wheel replaced with a cotton wheel and some rouge for buffing. Though this is great idea (and one we covered above), it is extremely time consuming, as each part is essentially hand buffed. I made this comment to Tim about the time issue, and he mentioned he had heard about "rock tumblers". He even tried the idea, but found it "messy, wet, and ineffective", and he abandoned the idea.

I knew there had to be a better way to polish small parts than using a buffing wheel. The wheel method is good for large parts, but just sucked for small parts. Not being rejected by Tim's rock tumbler comments, I visited the local hobby shop and checked them out. Sure enough, they sold rock tumblers and the compound used to polish rocks. And as Tim had stated, this was a "wet" process using water and compound to polish the rocks. I told the salemen what I was trying to do, and that I needed a "dry" method of tumbling. He suggested I go to the local gun shop and talk to them.

Detroit is filled with gun shops, so a quick drive later I was talking to a gun salesman. Sure enough, gun "loaders" polish the brass shells before reloading them with gun powder. They indeed do this "dry" using a vibration tumbler. The compound of choice was either crushed walnut shells (for really dirty shells), or treated corn cobb media for a high shine. I purchased both products there at the gun shop, and then returned to the hobby shop and bought a rock tumbler (the gun shop did not sell tumblers).

Some quick experiments at home found "tumbling" the ideal way to polish small and irregularly shaped pinball parts! Any strange shaped object that isn't flat can best be polished with a rock tumbler. This worked GREAT for those Gottlieb nickel plated metal playfield posts used from 1964 to 1967. I also threw all my playfield screws and acom nuts into the tumbler to polish them too. I was absolutely thrilled with the results.

I spread the word of my discovery, and largely got rejected. Tim Arnold refused to believe it worked (he is stubborn). Steve Young also seemed less than impressed. Fortunately some of my other friends liked the idea, but didn't like the \$100+ price for a good quality rock tumbler. So one of my friends did a web search, and found gun supply shops selling vibration tumblers for around \$50. This was much more palettible to the cheap pinheads (but even at \$50 it took them a while to actually buy one).

I stuck with my rock tumbler (the money was already spent!) for awhile, and then finally broke down and bought *two* Berry vibration tumblers. I loaned one to Tim Arnold, along with some crushed walnut shells. That was in 2000. Tim refuses to return my tumbler, as he loves polishing leg bolts in it. I guess I changed his mind.

Word spread fast of the \$50 vibration tumbler and my experience with polishing parts. This even evolved into a business for some people. I know of one guy that buys the Berry vibration tumblers, puts his own label on it, and then resells it (along with tumbling media). Go figure. But I would like to think I was the one that got the ball rolling on this "cottage industry", even though I never profited from it.

The AR2 model tumbler I bought for \$100. Note the two rubber quart sized tumbler jars.



Rotation Parts Tumblers.

Rotation tumblers are available from any decent hobby shop. Buy a good one (around \$100), not the cheap "kiddie" tumbler (about \$30). The best/cheapest one I found was \$90, and had a single quart sized rubber tumbler jar. For another \$10, I was able to get this double tumbler with two quart sized rubber jars. For the extra \$10, this was definitely worth it. They also make a tumbler with a much bigger single jar, for tumbling larger objects.

The Dillion Precision CV-2001 vibration polisher.
It's huge with a 12.5 quart basin!



Vibrating Parts Polishers.

There are also vibration style parts rock tumblers. Otherwise known as a "vibration parts polisher", these work great for polishing parts too, and are cheaper. For example, check out Berry's Manufacturing which sells tumblers at www.berrysmfq.com, in the Accessories-Cleaning part of their web site. Their model 400 tumbler has a 4 quart bowl (part #965-555) and at \$53 seems to be a good deal. They also sell walnut shell media (required for any tumbler), part #775-221, eight pounds for \$15.99. Another company that sells tumblers is dillonprecision.com. Their CV-500 model basically the same as the Berry model 400, but more expensive. Dillion Precision also sells a CV-2001 for about \$160 which is HUGE, holding 12.5 quarts of walnut shells (compared to the Berry 400 with a 4 quart bowl), and has a much bigger commercial style motor. The CV-2001 is definitely the top-end of the vibrating polishers. Both the Berry 400 and the Dillion Precision CV-500 models have a large capacity bowl, big enough to polish an entire ball plunger assembly. The Dillion CV-2001 will polish multiple shooter rods at one time and just about any odd sized or large pinball part you have!

Which is Better, Rotating or Vibrating?

Frankly, I am not sure it matters! Most tumblers today are the vibrating design, but this is probably because there are less moving parts needed for a vibrating tumbler, so it can be manufactured for less. The vibrating style is more aggressive than the tumbling style. But vibrating models make more noise too. Really the best tumbler is the one that can be bought cheapest and easiest, and that is big enough to fit the parts that need tumbling.

Metal Tumbling (Polishing) Media.

The local hobby shop where I bought my tumbler only had material to polish rocks. Go to a gun shop to buy the metal polishing media (gun owners use a rock tumbler to polish brass cartridge casings). There are two types of media: "corn cob" and "crushed walnut shells". Three pounds of corn cob costs about \$5, walnut shells about \$10. Pet shops sell walnut shell media too. It is used for lining bird cages, and it is generally inexpensive at a "Pet Mart" type store. Corn cob media is just that; ground up corn cobs, and some polishing compound added to it. Walnut shells are the same, ground up walnut shells. Walnut shell media is a bit harder than corn cob, and will tumble badly corroded metals better. It is also less messy and tumbles a bit better than corn cob. For this reason I have stopped using corn cob media, and have switched to walnut shells. Corn cob media does put a better "final finish" on metal parts though. I hear there is also ceramic polishing media, but it is very expensive. The advantage to the ceramic media is there's no pieces of corn cob or walnut shells to pick out of screw slots. Also the ceramic media should last forever. Walnut shells and corn cob do have

a limited life - I change the media when it turns a dark color.

Often walnut shell media does not have any polish added to it (unlike corn cob media). To polish better, just put a squirt of Novus3 in the walnut shells. This works really well. Just squirt some in the bowl before turning it on. There are also commercial products that do the same thing like "Flitz". Personally I just use Novus3 as I already have the Novus.

Tumble Dry.

Regardless of the media you are using, tumble DRY (do NOT add any water!) This is unlike tumbling rocks, which you tumble "wet". Just fill the quart sized rubber tumbler jar up to half way full of metal parts. Then put in the walnut shell media so it fills the jar just over half full. Add a squirt of Novus3 too.

How long do you Tumble?

Most metal parts just tumble overnight or even 24 hours. If something is really corroded or gross, the longest I've ever tumbled was three days. Run the tumbler constantly in this time. Just turn it on, and walk away. If using a decent tumbler, it will run fairly quiet. The cheap ones make tons of noise. Tumblers are designed for this constant use. For example, when tumbling rocks, they run constantly for weeks at a time.

The only downside to Tumbling.

Tumbling parts is great; I just strip a pinball playfield of all metal parts (posts, screws, etc), and dump them in the tumbler, turn it on, and walk away. After a day or so, all the parts are new and shiney. The only problem is the slots in the heads of the screws. The media will get caught in these slots (that the screw drivers goes in to), and must be cleaned out before using them. It takes a couple of minutes to clean out all the screw heads with a metal dental pick or screw driver. But that is the only downside to tumbling metal parts. It is so much easier and safer than using a buffing wheel.

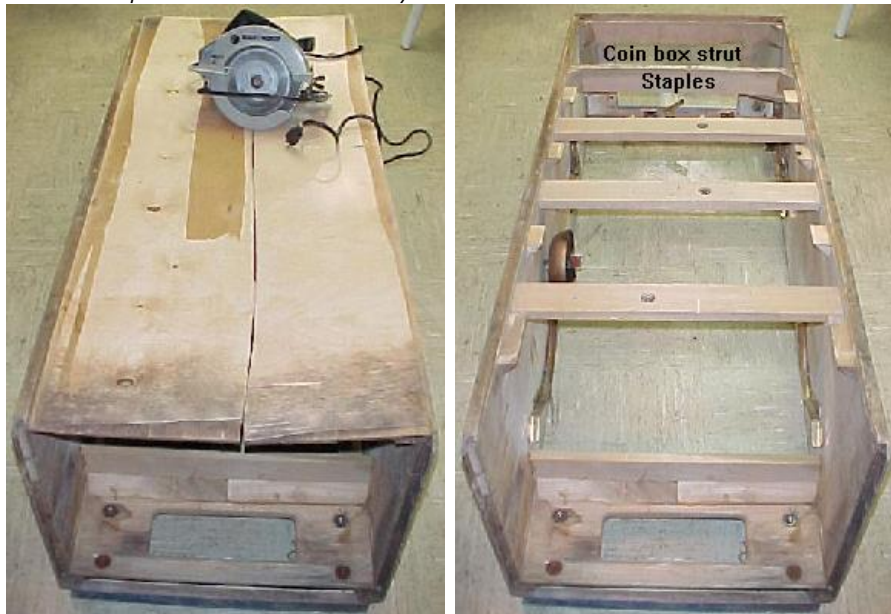
2a. The Cabinet: Replacing the Bottom Panel

If a game was stored in a web environment, often the bottom plywood panel in the game has warped, rotted, delaminated, and is in bad condition. If there is water damage, often this panel can just plain smell bad too. Since this is the bottom of the cabinet, this panel is not really seen, and doesn't have any artwork on it. It's an easy thing to replace. Here are the steps in replacing the bottom panel on a 1960's Gottlieb "wedgehead" game.

1. Remove the coin door, coin entrance panel, and the shooter. Basically you need to remove all the hardware from the front panel of the game.
2. Remove the playfield and the bottom panel (with all the relays attached) from the cabinet.
3. If the game is set up, remove the head from the game, and remove the legs.
4. Lay the cabinet on the ground, with the bottom panel "down".
5. Using a hammer, from the inside of the game, knock the back panel out of the game. It should come right out with just a few mild blows.
6. Using a radial hand saw, cut the bottom panel down the middle. BE CAREFUL: do not let the saw blade go deeper than 1/2" into the bottom panel!

Left: With the back panel removed, use a radial hand saw to cut the bottom panel right down the middle. BE CAREFUL! Do not cut too deep or you will cut the lower cross struts in the cabinet. Notice how the bottom panel has delaminated, and the water damage at the back panel.

Right: After the bottom panel is cut and removed. Note there are two staples through the bottom panel on the cross strut by the coin box.



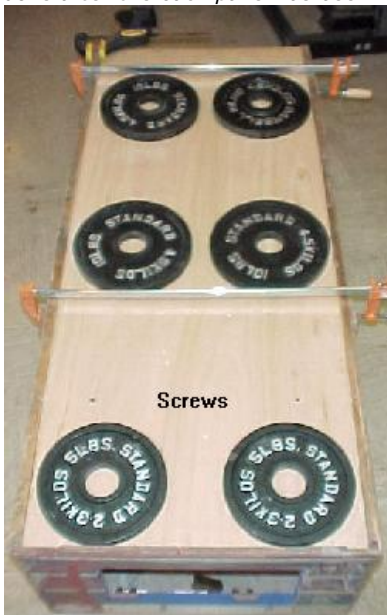
7. After the bottom panel is cut, it can easily be lifted from the center and removed.
8. Get a piece of "Lauan" from the local Home Depot store. Lauan is a type of inexpensive plywood with smooth sanded bottom and top. It comes in a 4 x 8 foot sheet, which is enough for two bottom panels, and cost about \$10. Home Depot cut the Lauan for me at no charge. For a 1960's Gottlieb wedgehead, it required a 1/4" thick by 51 1/4" long by 21" wide bottom panel.
9. Prepare the cabinet for gluing. Sand the coin box area cross strut and the triangle supports to remove any old glue. Clean the dirt out of any of the bottom panel channels.
10. Test fit the new Lauan bottom panel.

Putting glue in the front and side channels, and siding the new Lauan bottom panel in place.



11. Using yellow carpenter's glue, put glue on the coin box cross strut and all the triangle supports. Also put glue in the front and side bottom panel channels.
12. Slide the new Lauan panel into place. Clamp the cabinet from the sides, if possible.

Using weights and clamps to set the new bottom panel while the glue dries. This is done after the back panel has been re-installed.



13. Put two short dry wall screws through the bottom panel and into the coin box cross strut. I also added a short dry wall screw to the two rear-most triangle supports, and two screws into the center cross support.
14. Now immediately set the cabinet up vertically on the front coin door panel.
15. Clean back panel channels and put glue in the channels.
16. Replace the back panel. It may require a hammer to gently get it in place.
17. Set the cabinet back down, with the bottom panel up, and let the glue dry.

2b. The Cabinet: Checking a Re-Painted Cabinet for Original Paint

Often you'll buy a game that has the cabinet repainted. If you are lucky, the paint will be latex. Latex paint is very easy to remove using "Goof Off" (available at hardware stores). Lay the cabinet on its side, and soak an area with Goof Off. Let the Goof Off sit for a minute or two, then try and scarp the Latex paint off with a plastic paint scraper. Often you will be rewarded with the original finish beneath the Latex paint job. Several more coats of Goof Off and a rag will be required to get all the Latex paint off.

Note Goof Off is also available in a 'generic' form called Xylene. This is available at any hardware, and is much less expensive than Goof Off. But Xylene does not work as well as Goof Off. There are some additional ingredients in Goof Off (Methanol and Ethanol) that make Goof Off much more affective at removing old paint than straight Xylene.

This 1962 Flipper Parade cabinet was painted in a sick green Latex paint. I got it all off except for the front panel around the coin door, which was painted with an Enamel. To repaint the front area, Kyrion Antique White was used to match the original yellowed cabinet paint on the sides. The wire brush hanging from the ball loader was used to apply the splatter paint. Flipper Parade has no stencil designs on the front, luckily.



This has happened to me several times. I buy a game that has a repainted cabinet (and get it for a good price because, well, it's repainted!), and remove the ugly repainted latex. This has saved me from having to completely strip and repaint the cabinet. Original cabinet paint is a must for any "keeper" game for me, regardless of its condition.

If the cabinet was not repainted with Latex paint, the Goof Off won't have any effect on Enamel or Lacquer paints. Sometimes using a heat gun and a paint scraper can get these finishes off the cabinet. But often the paint is just stuck too well to the cabinet, and won't come off without destroying the original finish beneath it, if it's even there.

I've also had some luck using "whimpy" paint strippers. The more organic and water-safe paint stripper will sometimes take off a top coat of consumer applied paint, and leave the original

factory finish largely untouched underneath. It doesn't always work, but often it does enough where you can at least see the original paint designs, and make tracings of them for a re-paint.

2c. The Cabinet: Repainting a Cabinet.

Last Resort.

Repainting a cabinet is an ugly, big job. But if someone already stripped all the original paint off the cabinet, there isn't much choice. If there is any way to save the original finish, I always try. To me, a scratched, original cabinet is better than a mint, perfectly refinished one. Because original is original - once originality is gone, the time capsule of history is gone and there's no going back (a repainted cabinet can always be repainted again).

A common thing to see is a partial repaint. Often, the front of the cabinet where the coin door is mounted is the only part repainted. This is good and bad news; many Gottlieb games don't have any stencil designs here, so repainting this area alone is pretty easy.

What is the "Webbing" or "Splatter" on Cabinets all about?

When Gottlieb changed from a "woodrail" cabinet design to "metalrails" in 1960, the cabinet paint design also changed. Gottlieb woodrail cabinets were painted a base color (often yellow), with lots and lots of stencil painted geometric designs of up to three different colors. With the advent of metalrail cabinets, this changed. Now the base cabinet color was white, and there were far fewer stenciled geometric designs, and just two colors.

Using less stencils and less colors saved money. The stencils were less complicated to make, and used less colors (saved paint and time). But this meant the cabinet's base color was much more pronounced.

Because of this, a "webbing" or "splatter" design was added to the cabinet right after the base color (white) was painted. The webbing broke up the large white areas, making defects in the paint and wood less noticeable. The job of the webbing/splatter was to basically introduce artificial defects to the paint, thus making the "natural" defects far less pronounced! Also large areas of unstenciled white just looked better.

Did my Early 1960s Gottlieb Cabinet use Black Webbing or Silver Splatter?

Most Gottlieb EM metal rail games from 1960 to 1978 use a black webbing paint over the base cabinet color. There are some exceptions though, most notably games from about 1960 to 1963, which sometimes use silver splatter instead of black webbing. However anything 1963 or later should have black webbing. If not sure about the game in question, check for original paint on the inside of the sides of the cabinet (above where the playfield is mounted and below the metal side rails), or under the legs, or any other area that did not get much wear. Gottlieb used more than one company to make cabinets, and these different companies did not get the webbing/splatter designs consistent until about 1963.

The head on a 1965 Central Park. Note the factory original black webbing paint, and the blue and orange stencil paint is OVER the black webbing.



Repaint Steps (partial or full):

1. Remove the backbox from the cabinet.
2. Remove the coin door and coin entrance slots. Also remove the legs.
3. Check for Original Paint! If the original paint is under the current repaint, try and save it! Or at least try and make tracings of the original stencil design on the cabinet as you remove the repaint, if possible. Use Goof Off and see if you can remove the repaint.
4. If the entire cabinet was repainted, check other places for the original paint. For example, lots of novice painter don't remove the legs when repainting a game! Often the original paint colors can often be seen underneath the legs, and the colors matched from these areas. Additionally, check the inside the cabinet too. the area just below the metal side rails on the inside of the cabinet should have the original paint (though it will only show the base cabinet color, and the webbing/splatter color).
5. On a full cabinet repaint, if possible, remove the metal side rails (if game is 1960 or later). Getting metal side rails off without bending them is TOUGH! You will need a way to remove the "twist nails" that hold the side rails. If you can't do this without damaging the side rails, STOP. Leave the rails in place. New twist nails are available from Pinball Resource.
6. If the original paint is under the repaint (but you can't get the repaint off with Goof Off), at least try and make a tracing of the original cabinet stencil designs. If this is not possible, check reference books or online pictures. Or have a friend with an original version of the game make a tracing of the stencil designs.
7. Remove the current paint with paint remover or a heat gun, and a pastic paint scrapper.
8. Machine or block sand the cabinet level with 100 grit sandpaper.
9. Fill any dents or defects in the wood. I like automotive body filler for this task, as it dries fast and hard. After the body filler is dry, block sand it flat with 150 grit.
10. Minor defects (and I do mean minor!) can be filled with automotive spot putty. Spot putty is basically thick primer, so it's just for filling very small imperfections. This takes about 30 minutes to dry, and should be block sanded smooth with 150 grit.

Doing a partial repaint on the coin door area of a Gottlieb wedgehead. Note the defects have been filled with body filler, and block sanded smooth. All areas that could get overspray have been masked off. I put a piece of masking tape over the original finish under the coin entrance plate. This allows me to compare my new finish to the original when done.



10. Sand the cabinet with 150 grit sandpaper.
11. Sand the cabinet with 220 grit sandpaper.
12. Sand the cabinet with 320 grit sandpaper.
13. Wipe down the cabinet with Naptha to remove any contaminates.
14. Tape off any cabinet areas that shouldn't be painted with a good quality 3M masking tape and grocery store paper bags to prevent overspray.

15. If doing a complete repaint, set the cabinet so it's positioned like the legs are installed.

After the first coat of Krylon Antique White has been sprayed. The first coat doesn't cover very well. Don't worry about it, as the second coat will look much better!



16. Use Krylon "Antique White" if you are doing a partial cabinet repaint (like the front of the cabinet) to match a yellowed cabinet finish. Works great on Gottlieb wedgeheads. If doing a complete cabinet repaint, Krylon "Ivory" is probably a better choice (it's less yellow looking).
17. If painting the entire cabinet, pick the colors you like. I like the Krylon brand of spray paint. Create a color swatch to aid in matching colors.

Creating a Krylon color swatch. This is very helpful when trying to match repaint colors. From right to left: Ivory, Antique White, Regal Blue, True Blue, Banner Red. These are most of colors needed for 1960's Gottlieb cabinets.



The cabinet after three coats of Krylon Antique White.

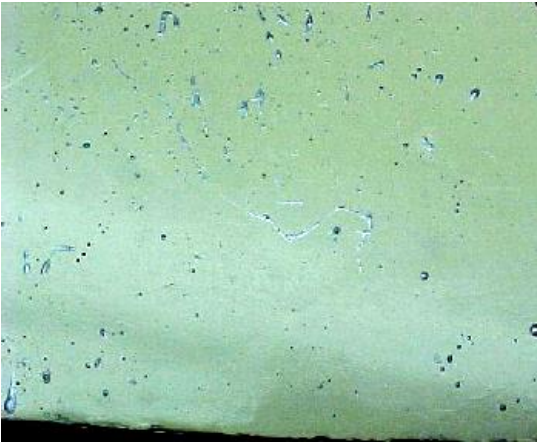


18. Spray the base coat (usually white or an off-white). Spray just enough finish to cover! This is usually two coats, and no more than three coats. Original cabinets do NOT have a lot of paint on them! Generally speaking, you do not have to sand between coats. But sanding after the second coat with 400 or 600 grit, and applying the third and last coat, will give a smoother looking cabinet.

Note if you have done good surface preparation, you do not need to sand between coats. Also you do not need to use any primer before the base coat. None of the original pinball maker used primer, and neither should you!

If repainting the entire cabinet, I personally like to use auto acrylic lacquer or enamel paint and a spray system. But often good results can be used just with good quality (Krylon) spray cans. Light sanding between coats (600 to 1000 grit wet/dry sandpaper) is recommended.

Adding the silver splatter after the Antique White has dried.



My new paint surrounding a taped off original paint section under the coin entrance plate.



Black webbing paint from a can. I stood three feet from this paper to get the can webbing to be finer. This product gives webbing just too thick and heavy for pinball cabinets. I would avoid using this product.



19. After the base coat is dry, add the "webbing" or "splatter" paint. Note some Gottlieb games from about 1960 to 1963 use silver splatter instead of black webbing. Anything 1962 or later should have black webbing. If not sure about the game in question, check for original paint on the inside of the sides of the cabinet (above where the playfield is mounted and below the metal side rails), or under the legs, or any other area that did not get much wear.

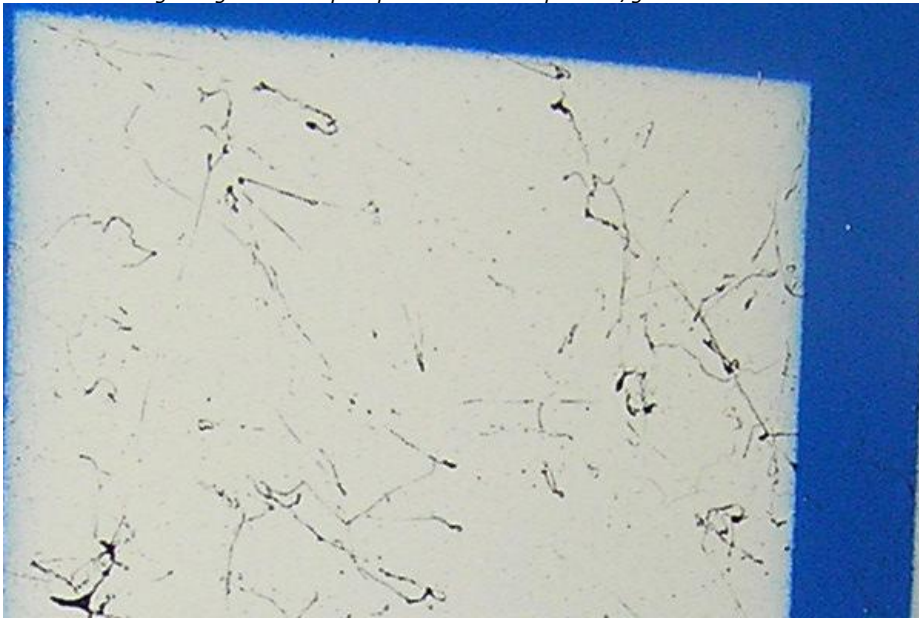
Original webbing used on a 1962 Gottlieb Flipper Clown.



Redone webbing using black lacquer paint and a small Weiler 30918 wire brush.



Redone webbing using black lacquer paint and a compressor/gun.



Webbing with a Wire Brush.

The webbing is always black, but silver splatter was also used on some 1960-1963 cabinets (note the silver was a splatter design, and not webbing like the black). Depending on the thickness of your paint, a small wire brush (I bought mine at Sears) can be dipped in the paint. I found thicker paint with a wire brush worked best for me. The paint I like to use for webbing is black lacquer. This can be bought at furniture stores in one gallon cans (Pratt-Lambert is the brand that I bought).

The style wire brush I found to work well is available from a variety of sources, and is called Weiler Brush 30918. If you do a Goggle web search you can find this brush. Heck even [Amazon.com](https://www.amazon.com) sells them.

The Weiler 30918 wire brush used for webbing.



Dip the end of the wire brush into the unthinned paint, then flick the wire brush with your thumb to splatter the webbing paint onto the cabinet. Practice this first on cardboard! Having too much paint on the wire brush will give webbing that is too thick.

Note thin paint gives more of a splatter pattern, instead of a webbing pattern. If your paint is too thick, dip the wire brush first into some thinner, then dip it into the paint. This will thin the paint slightly (though I don't recommended thinning the paint).

Be conservative when webbing a cabinet. You don't need a ton of webbing. If you want to go back and add more after you do the whole cabinet, this is easy to do with the wire brush technique.

Practice is the key to good webbing. This is a simple and easy process. An entire cabinet can be splattered using a wire brush in about 10 minutes. You can clean the wire brush in lacquer thinner, or just throw it away and buy another. Not adding the webbing/splatter to a cabinet repaint is a sign of a true novice paint job. So practice and do the webbing.

There is also a commercial splatter brush available that works well, called the [Kemper Splatter brush](#). It costs less then \$3 so it is worth trying. Note this produced a SPLATTER and *not* a webbing effect. It also makes a very uniform splatter.

The Kemper splatter brush.



Webbing with a Compressor and Gun.

Gottlieb originally did splatter with a compressor and gun. If you have the equipment, this works too. Same black lacquer paint is used (again I like the Pratt-Lambert black lacquer, but automotive black lacquer will work too, just it's more expensive).

Again you will have to experiment. But here's basically how it works: Set the compressor to around 40 to 60 PSI. Open the cup on the sprayer and pour in some unthinned black lacquer. Get the nozzle on sprayer fairly open. Practice spraying. That's about it. The unthinned paint should splatter fairly well.

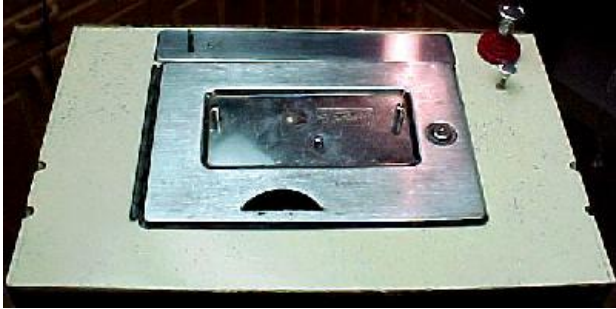
The type of gun does matter, and the cheap production touch-up guns seem to work well for this. You want an "old school" style gun designed for higher pressure and lots of overspray. These small touchup style guns seems to work well, and are fairly inexpensive. Do not get a HVLP gun.

A Touchup style gun used for webbing.



Which method you use for webbing paint depends on your situation and availability of equipment. From the pictures you can see the results from the Weiler 30918 wire brush and the compressor/gun techniques are nearly identical. Use whatever works better for you.

The front cabinet repainted and webbed.



Adding Stencil Patterns.

Most games use a stenciled color pattern somewhere on the cabinet. To do a good re-paint job, you must re-create these patterns. Some people think the webbing is done after the stencils. From the above picture of the 1965 Central Park you can clearly see the stencils go over the webbing, and the stencils are the last step.

After the webbing paint is dry, then do your stencils. Do NOT tape off the cabinet and paint the designs! That's not how cabinet designs were painted (remember the designs are called "stencils", and not "tape offs"). The idea is to recreate the original process and look of the cabinet, and taping off designs was not how the cabinet was originally painted.

Making Stencils.

Hopefully an original cabinet is available to recreate the stencils. Or if you were able to strip-off the over-paint revealing the original cabinet designs to some extent, so this can be used to make stencils.

*This cabinet was repainted *twice*, yet I was able to use thin coats of paint stripper to remove the overpaint, thus revealing the original cabinet designs. Then I took a Sharpie pen and a straight edge, and re-drew the stencil patterns. From this I could easily create a **tracing** of the cabinet designs. After the tracings were made, the cabinet was further stripped and prep'ed for painting. Note the nasty animal chew hole in the coin door! This obviously was filled before repainting. I used automotive body filler and wood.*

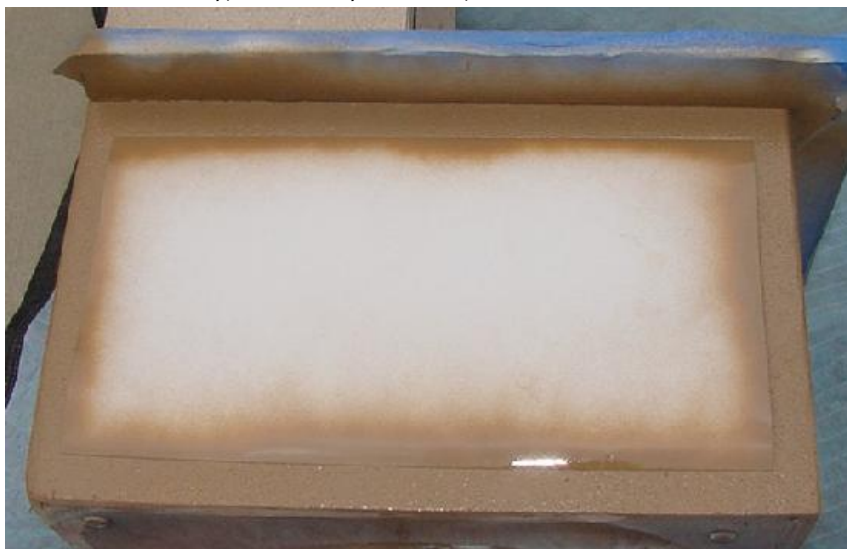


Large sheets of tracing paper are best when tracing an original cabinet. These are available from blue print and engineering supply stores. If the original cabinet to be repainted has dubious stencil designs, they can be quickly redrawn with a Sharpie pen and a straight edge. Then the process of tracing the designs is much easier. You will be painting the cabinet anyway, so drawing on it is no big deal. Note one tracing is needed for each color.

If want to do a quick repaint, use posterboard for the actual stencils, one piece of poster board for each color. Or use .050" thick picture frame mat (available from picture framing shops) for stencils. You can usually get this mat large enough for the entire side of a cabinet. The thicker .050" mat means the stencil won't curl when painted. Originally original manufacturers used thin brass stencils. Using posterboard or framing mat is much less expensive, and easier to cut. The

downside to using posterboard is it warps after a single use, making it much harder to use a second time. This happens because as the oversprayed paint dries on the posterboard, it changes the surface tension. Keep this in mind if multiple cabinets are to be sprayed, and use the thicker .050" thick matte to prevent it.

Using the Bren Ultra-Cut II stencil material. This stuff is really nice, doesn't curl too badly, has a tacky back side, and is reusable.



If you really want to make good stencils, it's a nice idea to use material designed just for that. I have been using with stencil material from Bren Instruments, Franklin TN (800-826-3991) <http://www.bren.org/stencil.htm>. Their 8.5 mil thick Ultra-Cut II seems to be a good choice, as it is a reusable general purpose stencil material with a light tack adhesive to hold it in place while painting. This 8.5 mil, semi-rigid plastic conforms easily to curved or irregular surfaces, lightly holds itself in place and is impervious to inks, paints or stains. It comes in 30" wide, 100 foot rolls (enough for about five pinball cabinets, depending on how many colors it has). It's not cheap, a roll will cost \$100, but it is well worth it. They also make the SSB-Cut stencil material, which is basically the same as the Ultra Cut II but is thicker (10 mils). It also has the low-tack sticky back (I don't really see any advantage to the thicker stencil material). And lastly I have also tried the Clear-Cut B, which is 7 mils thick and of course clear. This material saves the step of using tracing paper! But the downside is it does not have the sticky low-tack back. For my money the best is the Ultra-Cut II and the Clear-Cut B. Which I use depends on my mood and if I have some Krylon spray Easy-Tack spray adhesive handy to use with the Clear-Cut B.

After removing the Bren stencil material.



The Bren stencil material will also curl after paint is applied. But it's not nearly as bad as posterboard or matte. Also the tacky back side is very helpful in positioning the stencil. I do also add some weight to the stencil too, because after a few applications the tacky side is, well, less tacky. But it is still way easy to use than posterboard, and much more reusable.

The stenciling complete. The lower designs were done with the Bren stencil material. The upper straight designs were done quickly using cheap boards as the stencils. This proved to be much easier and quicker than cutting stencils.



Some people are using some very thin, one-time use stencil material like Frisket paper. I find this material extremely hard to work with, and it's good for one time. What if you have to use the same design on another part of the cabinet? Well you have to make/buy another stencil and deal with the thin material again. Not worth it in my book! I find the Frisket paper to be very amateur like a kid's toy, not a real stencil.

Before starting to cut the stencils, note the order of the colors. On many cabinets, it does matter which color stencil pattern is sprayed first. And this can affect how the second and third template should be drawn.

*Krylon spray Easy-Tack
#7020 repositionable adhesive.*



To create a stencil, put the tracing paper over the posterboard or matte. Use an Exacto knife to cut through the tracing paper and into the poster board. A straight edge can be used to make clean straight cuts. Make sure to clean up the corners of your cuts with an Exacto knife so they are clean and crisp.

Spraying the Stencil Colors.

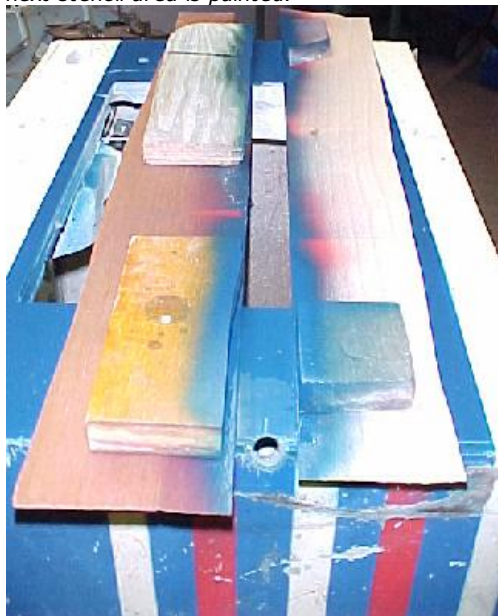
After cutting the stencil with an Exacto, set the stencil against the cabinet and check for alignment. To hold the stencil down against the cabinet, small weights can be used. For thin areas of stencil, use inexpensive kid's double sided tape to hold the stencil down. Or an even better idea is to use a "light tack" spray adhesive. Spray the light tack onto the stencil (not the cabinet!), and position it as needed. This works really well, but experiment with the spray tack first, to make sure it does not mess up your paint.

After the stencil is secured to the cabinet, LIGHTLY spray the designs with some sort of spray paint. Spray just enough paint to cover, and no more. A common problem is spraying too much paint, and the paint pools at the edge of the stencil. Then when you pull the stencil off, the edge line is distorted from the pooled paint. Also several light coats is better than one heavy coat.

When pulling the stencil off the cabinet, be careful not to smear

the freshly sprayed paint. I personally like to remove the stencil when the stencil paint is still wet, otherwise the stencil can get stuck to the cabinet by the drying stencil paint.

Repainting the front of a Gottlieb Cross Town. Since the front stencil patterns are straight, I used thin and straight wood laminates as stencils (instead of cutting out stencils). The laminates are put in place, and weighted with some blocks. Then the paint is lightly sprayed, and the stencils immediately (and carefully!) removed. After this stencil paint dries, the next stencil area is painted.



The Cross Town cabinet with the new repainted front. Note the Krylon colors matched very well to the original cabinet side art.



2d. The Cabinet: Legs and Coin Door (rust removal)

Untreated raw rusted leg on left, treated shiny leg on right.



Most likely your game will have some rust on the legs, coin door, and coin entry panel. If not too extreme, you can get the rust off. If excessively rusted, you'll have to replace these parts. Luckily, they are available from Pinball Resource, but are a bit expensive.

For the legs first remove the old leg levelers and throw them away.

To remove the rust, I recommend **Lightning Rust Remover**. It's available from Real Products, Ney Ohio, 800-659-2459, at \$25 per gallon. Shipping is an extra \$5. This stuff works great. I use a combo sponge with green pad on the back of the sponge to apply the remover. Just keep the surface wet for about 5 minutes, and occasionally scrub with the green pad side of the sponge. Or just scrub with a regular Scotchbrite green pad. Wash off with water and dry.

Once all the rust is removed, you can polish the legs further with your buffer. That will make them really shine. After the legs and coin door are clean and shiny, wax them. This will protect them from any new rust. Install new leg levelers.

If the coin door or legs are excessively rusty and Lightning didn't get all the rust

off, you can also sand off the rust 340 grit wet/dry sandpaper (using it "wet" with water). Then follow this by buffing the parts on a buffing wheel.

2e. The Cabinet: Put the Legs On (stripped threads)

Before you install the legs, examine the original leg bolts. Are the threads stripped? If so, you can bet the threads inside the cabinet (on at least one leg) are stripped too. If the leg bolts are in bad condition, buy new ones. Pinball Resource sells new leg bolts for 50 cents each.

A 3/8"-16 tap and die. Note the tap handle (above the tap). Not necessary, but it does work a lot better than a small adjustable wrench!



Before I install the legs, I always recondition the threads inside the cabinet using a 3/8"-16 Tap. This is available from any decent hardware store for about \$3. If you want to recondition the original leg bolts too, you can also buy a 3/8"-16 Die for another \$3. Put the die in a vice, and thread the old legs bolts into the die. This will clean up any stripped threads.

Note you can also buy new leg plates too. In many cases, re-tapping the leg plates just will not work. They often need to be replaced. These are available from Pinball Resource for about \$1 each.

If you do keep your original leg bolts, polish each bolt head on the buffer. Makes them look a lot better.

2f. The Cabinet: Clean the Outside

Using a cleaner called "Mean Green" and a paper towel or even a worn Scotchbrite pad. See how much whiter the finish is?



After the legs are on and the game is set up, clean the outside of the cabinet. **WARNING:** before using any cleaning product on the cabinet, try it in a small unnoticed area first (like the cabinet paint under where the legs bolt).

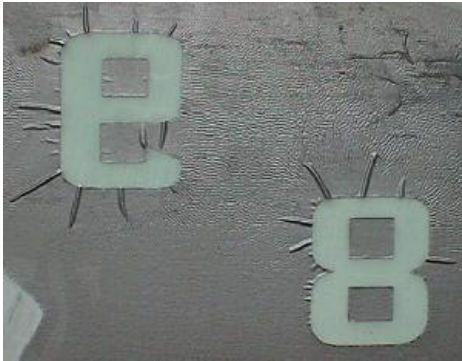
I personally like Mean Green for most cabinet cleaning chores (Mean Green is not the same as Simple Green by the way). Mean Green is available from most dollar stores, Meijers, and other grocery stores (my local grocery sells it). The stuff works great on old EM cabinets to new 1990s game cabinets.

On EM games, the cabinet is often yellowed (look at the cabinet paint under the legs and compare). My general approach is to spray the Mean Green onto the cabinet, wait ten seconds, and then wipe it off with a paper towel. Right after doing this, examine the paper towel. Make sure there's no cabinet paint on the towel! Usually the paper towel will have a sick brown sludge. This is good. I usually apply one or two more applications of Mean Green, until the paper towel no longer shows any yellowish/brown crude. At this point STOP. If Mean Green is over applied, cabinet paint could start to soften and come off on to the paper towel. Mean Green works great, but it can remove cabinet paint on some older games. This does not seem to be a problem with newer games.

2g. The Cabinet: Save the Backglass (Krylon Triple Thick)

Note: If your backglass is perfect with no flaking or crazing, skip this section.

The start of backglass delamination. Arrest this before it becomes fatal.



This picture shows the beginning of backglass delamination. This needs to be arrested before the backglass is wasted. The cause of the paint delaminating from the glass is largely environmental. Changes in temperature is the biggest offender. The ink/paint and the glass have different expansion/contraction rates. When the temperature changes, the paint will react sooner than the glass. Since the glass can't give, the paint will instead. This causes cracks in the ink/paint. Cracks allow humidity to get between the paint and the glass. Delamination is certain.

The backglass and the clear used to save it.



*Left: Krylon's Triple Thick Crystal Clear.
Right: Krylon's Acrylic Crystal Clear,
a thinner version of Triple Thick.*



The History of Backglass Preservation.

The first commercial product used to save delaminating backglasses was "Cover Your Glass" (CYG). Cover Your Glass was applied by actually pouring it on the backside of a backglass while it was lying flat, and allowing it to dry in a very thick entombing layer. This worked well for glasses that were really delaminating and partially beyond saving, since the paint chips would not blow off since CYG was not sprayed. Steve Young's Pinball Resource owned the formula to CYG, so he was actively pushing that product (though Tim Arnold and others had warned him of CYG's problems).

CYG has been around for a long time and came in two formulas, "regular" and "light". The light version was better, but overall Cover Your Glass sucked. It is a polyester product and cracks, especially if there is any sudden temperature changes (much like the original backglass paint you're trying to save). The cracking was so bad in some cases it made the CYG'ed backglass useless. For this reason most people abandoned it. Also CYG goes on so thick, it really made any backglass touch up

impossible after it was applied.

The other product often used is Krylon's "Crystal Clear". Though Crystal Clear is a good acrylic lacquer type product, its film thickness is just way too thin for backglass preservation. For it to be used affectively, at least five (or more) good coats need to be applied. But be careful, don't apply it too wet or it can bleed the backglass inks. For this reason it's just not a practical product to use in backglass restoration (though I do use it for other purposes in pinball repair, like putting a thin coating on sanded/polished metal to prevent rust). But many people used Crystal Clear because it really was the only "decent" product available (other than CYG) for a long time.

Mylar and Shipping Tape.

Another technique tried probably even before Cover Your Glass came along was the shipping tape/mylar technique. This involved putting clear shipping tape or mylar over the areas of the backglass that are delaminating. The delaminating ink/paint sticks to the tape/mylar as it is applied, and the tape sticks to the glass surface, holding it in place. At first this sounds incredibly stupid, but it actually works quite well. The down side is that it's a short term fix. With age shipping tape will delaminate and yellow, falling off and taking the loose ink/paint with it. Add the heat from the backglass lightbulbs, and the problem is worse. Mylar is much better in this regard, but still has this potential problem. Using either product does not allow any future touchup of the backglass, which is a big downside. And once either tape/mylar is applied, there's no going back, because it can not be removed without removing the backglass ink with it.

I use the shipping tape/mylar technique when I go buy a game from someone where the backglass ink/paint is falling off as I move the game (at this point I *know* I'll be looking for a new glass anyway, so there's not much to lose). It allows me to save at least some of the backglass graphics before I move the game (and all the ink/paint falls off!)

I would not suggest using mylar (which is much better than shipping tape) unless the backglass is in really bad condition. If the flakes are very loose, spraying a coating without blowing the flakes off is difficult. Therefore mylar is really the only option. Mylar does work quite well, and is very permanent. I really don't suggest shipping tape because it will eventually delaminate (as it's not designed for long-term hold).

Introducing Krylon's Triple Thick Crystl Clear.

In about 1997 I started using Illinois Bronze/Krylon's "Triple Thick Coating" to save backglasses. This is a spray product, much like [Krylon's Acrylic Crystal Clear](#), but it produces a much thicker film with far less coats. Krylon calls Triple Thick it a "glazing product", but only because of the film thickness produced. [Triple Thick Crystl Clear](#) is essentially a thick filmed acrylic lacquer. This makes it ideal for backglass preservation. Most backglasses are silkscreened using inks. But after the ink is applied, the manufacturer's usually put a lacquer type coating over the inks to "lock them down". Because Triple Thick (and Krylon's Crystal Clear for that matter) are a similar product, Triple Thick works very well to lock down delaminating backglasses, and does not have the bleeding ink problem that Crystal Clear has.

As a test of Triple Thick, in 1997 I applied two wet coats to a 1978 Bally "Strikes and Spares" backglass and to a 1973 Williams "Upper Deck" backglass. These backglasses were starting to delaminate, and had about 10% to 20% ink/paint loss. After I sprayed the backglasses, I left them in my garage year round. I live in Michigan, and there is plenty of temperature change between the seasons (it gets pretty cold here in the winter!) To date (over five years later), the backglasses are in the same condition as the day I sealed them in 1997 with Triple Thick. No additional ink/paint delamination has occurred, and the Triple Thick has not cracked (like Cover Your Glass).

To my knowledge, I was the first to use Triple Thick for pinball backglasses, and I attempted to introduced it to the pinball world. The first people I told about the product was Tim Arnold and Steve Young. Tim was looking to find a product to save delaminating backglasses (at the time he was using Krylon Crystal Clear, and was somewhat happy with the results). Steve Young was using/selling "Cover Your Glass". Since Steve had a financial interest in CYG, he was not overly thrilled with my Triple Thick discovery.

It took Tim Arnold and some others a while to accept the new Triple Thick product. But after one use, I don't know anyone that doesn't like it. The establishment of Triple Thick as the "pinball backglass standard" forced the sales of CYG to nearly nothing, and Pinball Resource no longer sells it to my knowledge.

Triple Thick is available at Kmart, Walmart, Sherwin Williams paint stores, or any decent crafts store like Micheals Crafts. Both the Kyron and Illinois Bronze products are the same, just marketed differently in different areas. They also have a web site at www.krylon.com/product/op_craft.asp where you can click on "Triple Thick" for more information. I find Triple Thick locally at Kmart/Walmart, Michael's Crafts, or even some Ace Hardware stores. Home Depot and most other hardware store do not seem to sell it.

Alternatives to Triple Thick.

Really there is only one alternative to Krylon's Triple Thick, and that's [Aerovoe's Clear Acrylic](#). Only available through Aerovoe.com (that I am aware of), this is a product very similar to Krylon's Triple Thick. Unfortunately you can only buy a case of twelve spray cans for about \$45, so it may not be the best alternative for most

people. Also the advantages of Aervoe Clear Acrylic over Krylon's Triple Thick are minimal, if any. But if you don't like Triple Thick for some reason, there is an alternative! I don't know of anyone that has tried Aervoe's Clear Acrylic other than myself and one other person. It's a good product, but not really worth the hassle of buying an entire case mail order.

Aervoe's Clear Acrylic.



If You Can't Spray Paint, Please Do Not Attempt to "Triple Thick"!

I do have to explain this, but some people just don't know how to spray paint. They just suck at it. If this is you, then please DO NOT spray Krylon Triple Thick on a backglass! I thought "rattle cans" were pretty much idiot-proof, but they are not. I'm not trying to sound arrogant, but really some people just don't know how to get a good smooth glossy finish using spray cans.

I have probably Triple Thick'ed 100 backglasses, and have never had a problem. But I get emails from people that just can not do this even once without having issues. They either put the Triple Thick on too heavy or too thin, and just make a mess out of an other good condition backglass. If you can't put a good professional looking finish on a piece of flat metal using a rattle can, then you have no business applying Triple Thick to a pinball backglass.

After applying Triple Thick, the coating on the back of a score glass should be shiny, glossy, and smooth. There should be no overspray misting or separation of the backglass film. It should look good! Practice on a junk backglass first if you have any doubts.

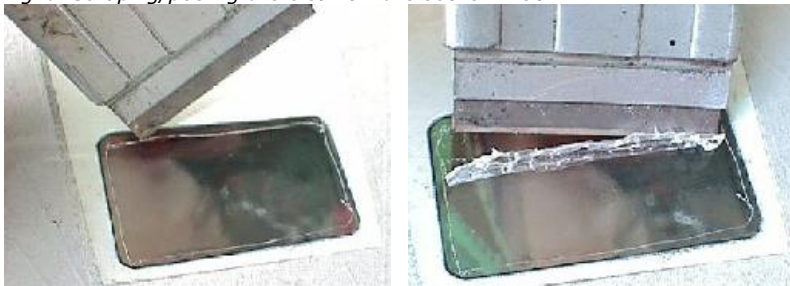
Preparing the Backglass for Triple Thick.

Before spraying the backglass, clean it if possible. If there is any or significant ink/paint flaking, skip this step! If the ink/paint is mostly intact and just starting to delaminate, I would suggest this. Often a backglass can have a thin film of oil, grease or other crud on it from the stepper units and score reels. If this is not removed, the Triple Thick may not "stick", resulting in "fish eyes". Because of this, I personally find it is best to try and clean the painted side of the backglass if possible. Again, if the backglass ink/paint is starting to delaminate, skip this step!

To clean the painted side of the backglass, take a paper towel and spray the paper towel with Windex (don't soak it!) Never spray Windex directly on the backglass. Spray the Windex on the paper towel. Now gently wipe the score windows and credit window. After doing those, *gently* wipe any other "solid" (not delaminating) sections of the backglass. Remember, don't go nuts and cause more problems. "The enemy of good is better" is something that should be repeated while doing this chore. Examine the paper towel for crud or potential paint loss. See all the dirt on the paper towel? Removal of this crud really helps the Triple Thick "stick" to the backglass ink/paint.

On backglasses with score reel windows, a business card can be cut and layed over the clear score reel windows. Use a penny or a nickle to hold the card down. This is optional (often I just spray over the score windows completely).

*Left: Score the score windows with a razor blade.
Right: Scraping/peeling the clear off the score window.*



Applying the Triple Thick.

After the glass is dry from cleaning, it is time to spray the Triple Thick. Put the backglass flat on a solid surface. If the backglass ink/paint is really delaminating, I spray the first coat of Triple Thick about 18 inches from the glass, and move the can very quickly. This will provide a "misting" coat to get the delaminating paint to stay in place. Then let this coat dry a minimum of 30 minutes. A repeat of this quick and distant application may be required. If the backglass is not delaminating, my first coat is about 12 inches from the glass, and I move more slowly, applying more clear in a "wet" overlapping coat.

If the backglass is heavily peeling, please skip down to the section below, [Saving a Severely Peeling & Flaking Backglass.](#)

After the first coat(s) of Triple Thick is down and dry for at least 30 minutes, I spray one or two more "wet" coats. The first coat of Triple Thick should have all the backglass paint solid and in place. So the "wet" coats can be applied with the spray can much closer to the glass, laying down much more Triple Thick again in a "wet" coat. Spray the coats in perpendicular directions if possible. That is, spray left to right on the first coat, and then up and down on the second. I find that at least 30 minutes of dry time between coats is needed.

A common question is, "how much Triple Thick do I need to apply?" Generally speaking, two wet coats is all that is needed. Do not go wild and apply more than that. Too much Triple Thick can be a bad thing (but also too little Triple Thick does not really protect the backglass).

On backlasses with score reel windows, if they were not masked before spraying, they can be razor bladed to remove the Triple Thick. Note if the proper amount of Triple Thick was applied (not too much!) and the windows were clean, I often leave the score windows with the Triple Thick on them. If you did a nice job spraying, usually the Triple Thick can not be seen. If this is not the case, after 30 minutes of drying time on the last coat, use a razor blade or exacto knife and score the outside edges of the score reel windows. Do this about 1/8" on the inside edge of the paint. This allows the new finish to overlap the backglass paint. If you allow the paint to fully dry before scoring it (not recommended!), heat your razor blade or exacto blade so it is hot, then score the paint. The heated blade will cut the clear coat much better.

After scoring the new finish, scrap/peel the clear from the windows. Use the razor blade for this job (or a razor blade broken in half). I usually do *not* razor the credit window. When complete, let the glass dry overnight. Then use Novus#2 on the score windows to remove the "edge" from razor blade scraping.

Saving a Severely Peeling & Flaking Backglass.

Mark got me going on this, and here's my take on it. If the backglass has a lot of curled, flaking, peeling ink/paint, but most of the "ink pieces" are present, there is a way to save it. This technique will also minimize the amount of touch up required to fix the peeling ink/paint.

The problem with flaking backglass ink/paint is the loose paint chips tend to curl up. Spraying Triple Thick usually will not make the paint chips 'lay down'. So we need some technique to get them flat, so they will re-attach to the backglass.

The trick here is to use "plastic wrap" (I have found the Glad brand "ClingWrap" to work best). The plastic wrap will act as a barrier between you and the wet Triple Thick. The trick is to spray a "wet" coat of Triple Thick on the backglass. Then right after the Triple Thick has been sprayed onto the backglass, put a layer of ClingWrap over the wet Triple Thick in the areas where the backglass ink/paint is peeling. The ClingWrap doesn't have to be stretched tight, and it only needs to be applied in the areas of peeling paint. Try and apply the clear wrap with no creases if possible. The reason for this is simple: if Triple Thick gets inside a crease, the clear wrap will have a harder time coming off the backglass after the Triple Thick dries.

Applying the Cling Wrap over the wet Triple Thick on a heavily peeling backglass.



After the Cling Wrap is on top of the wet Triple Thick, press the clear wrap down with your fingers in any area where the backglass ink/paint is peeling. Actually push down the peeling paint. Paint chips can even be shifted and moved slightly if you are careful. The ClingWrap will keep your fingers separated from the wet Triple Thick. After all the paint is pushed down and into place, leave the glass alone (do *not* try and remove the ClingWrap!)

Removing the Cling Wrap from the backglass after the Triple Thick has dried.



Now let the Triple Thick dry overnight. This is very important! The Triple Thick must fully dry before proceeding. After drying, the ClingWrap should peel off the backglass very easily, without bringing any paint with it! It should come off so easy, the ClingWrap should almost fall off. If it doesn't, the Triple Thick is either not dry, or there are creases in the Cling Wrap, which have trapped the Triple Thick, making it difficult to remove. Leave it alone let it dry longer. If the ClingWrap still won't let go from the backglass, sometimes a quick spray of 'cold freeze' (spray cold in a can, often used to remove mylar and to test electronic components) will release it. But be careful, as you don't want to get the backglass so cold that it delaminates the ink! (That would kind of defeat the whole purpose of this exercise.) If the ClingWrap still won't come up (rare, but I have heard of it happening), don't force it. Just trim off what you can with a razor blade and leave it alone. Note I have tried other products, but ClingWrap seems to work the best. And no, wax paper should not be used. The solvent in Triple Thick reacts with the wax, and makes a big mess (the Triple Thick doesn't dry well because of the wax).

Note there is some "texture" to the Triple Thick where the ClingWrap was removed. Don't worry about it, that is to be expected. After the Cling Wrap is removed, apply a second "wet" layer of Triple Thick to the backglass. Spray this second coat perpendicular to the first coat. The "texture" will go down a bit with this step, and the second coat locks the peeling ink/paint down even better. After the second coat is dry, the backglass is ready for touchup!

2h. The Cabinet: Touch-up the Backglass

Note: If your backglass is perfect with no flaking or crazing, skip this section.

Rack-A-Ball (front): this backglass was worn by the backboard. Too bad, because otherwise this was a very nice backglass.



Rack-A-Ball (back): the same section as seen from the back. Fortunately, this area is in an unlit (opaque) part of the backglass.



Often an otherwise perfect backglass will need to be "touched-up". I don't suggest doing this unless the wear or flaking is severe enough that you just can't live with it. Also, before you try this, make sure you have done the previous step. **Clear-coating the back of the backglass with "triple thick" is mandatory before you try this procedure.**

Warnings:

This is an experimental procedure. This is certainly not the only way to touch-up a backglass. This is just one approach that I find to be very forgiving, and easy for a beginner. Practice is the only way to get good at backglass touch-ups. So start with some junk backlasses and practice. We've all seen the results of bad backglass touch-ups. In many cases, the outcome was worse than the initial problem.

How it was originally done.

Originally, the "paint" used on backglasses is actually an ink. The ink is applied one color at a time by pressing it through a silk "screen" and onto the glass (the black lines are applied first, then the lightest to darkest colors follow). The silk is coated, but the coating is cut away in the areas where a particular color is to be applied, and squeezed through the screen. There is a separate screen for each color. The inks that are applied are translucent (allow light to pass through). After all the colors are applied, the areas that stay transparent are screened over with a translucent white which diffuses the light evenly. The colors that are opaque are screened over with a black mask (in the 1940's and 1950's) or silver mask (in the 1960's and later) and does not allow light to pass through the color.

Ideally, it would be great to use the original style inks to touch up a backglass. But in reality, this is impractical. The original Pantone Matching System (PMS) inks are very expensive, can only be bought in large quantities, and are hard to work with. Also once applied, there is no going back. They are not forgiving.

Opaque and Translucent areas: What's the difference?

After all the ink colors are applied to the glass, there is a final coat of opaque silver or silver mask (depending on the era of the glass), or translucent white screened over the colors. Areas that light up on the backglass are coated with a thin layer of translucent white. This white diffuses the light from the backbox light bulbs. Areas that are not lit are coated with a layer of opaque silver or black mask that prevents light from passing through the color(s). It's important to understand these different areas (you'll see why in a moment).

All the tools you'll need: water-based acrylic craft paints, a small paint brush, a black Sharpie marker, and some small pieces of glass.



An alternative approach.

Instead of using inks to repair a backglass, I suggest you use craft supply acrylic paint. The advantages to using this material are:

- Inexpensive. Usually about \$1 per bottle.
- Easy to find. I get these at my local discounter (Kmart, Walmart, Meijers).
- Lots of colors available.
- Water based.

The biggest advantage to these craft acrylics is the last point; they are water-based. This means if you apply them, and don't like the results, you can just wipe them off with a damp cloth. Since the backglass is coated with Triple-thick, you can do this many times without any damage. Triple-thick seals out the water.

What determines a "good" outcome?

How well this procedure works depends on two things: how good a job you did with the Triple-thick sealing process, and how good you can match colors. If the areas where there was no backglass paint were clean and flat before you used your Triple-thick, your outcome will be MUCH better. Also your ability to see color, and determine the make-up of a color, will also help greatly. Often it's helpful to have a (female) friend help with this last point.

Preliminary Analysis: Should you attempt fixing the Translucent areas?

For the most part, I would say "no" to this question. The non-silvered (or non-black) areas of a backglass are the hardest (by far) to touch up. These are the areas that allow light to pass through them. If you can help it, leave these alone! Since these areas allow light to pass through, if the repair paint you apply isn't the same *translucency*, the repair area will stick out like a sore thumb (even if the color match is perfect). It doesn't matter how well you match the color, you also have to match the translucency too. This is extremely difficult! For this reason, do not touch up the translucent areas of a backglass. To minimize any obvious ink/paint delamination from these backglass areas, remove some of the backglass #47 light bulbs from the backbox that light these areas.

Using Paint Retarder to Match Translucent Areas.

A way to touch up translucent areas is to use acrylic paint retarder (you may have to buy this at an art supply store). This liquid slows the drying time of the acrylic paint. But that's not what we're using it for. You can also add paint retarder to your mixed color to thin the color, and make it translucent. This works very well and allows you to match the translucency of the original surrounding paint. But applying the color in a consistent thickness is very difficult. I don't really recommend this technique.

Using Cellophane Mask in Translucent Areas.

Another approach to fixing translucent areas is to use a colored cellophane mask. To do this, you'll need to score the offending translucent area of the backglass with a hot exacto blade (which cuts paint without chipping it). Then all the defective

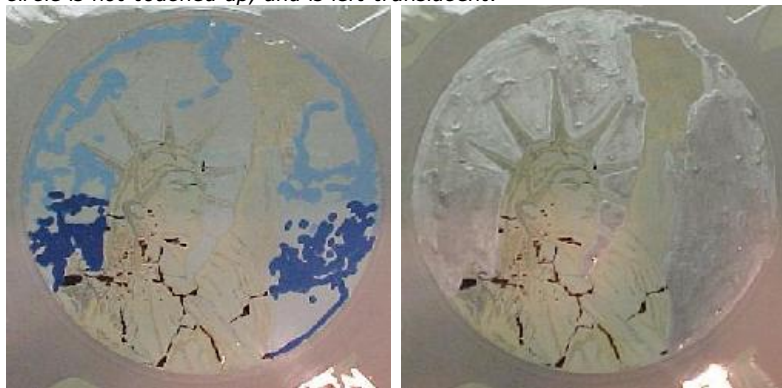
translucent color can be cut out and removed. But instead of re-painting this area, apply the colored cellophane, overlapping the area if possible. Stick the cellophane down with some tape on the edges. The colored cellophane will give the desired translucent effect. Not an ideal repair, but it works.

Making Touched-up Translucent areas Opaque.

I like this alternative the best. It makes a translucent area opaque, allowing for easy touch up. For example, if a transparent area has crazed and chipped, go ahead and touch up that area, but don't worry about matching the translucency. This allows you to touch-up the area without having to worry about how translucent your colors are. After the area is color matched and touched up, you can opaque the touched up area using silver or black paint.

Left: The area inside the circle is originally masked with translucent white paint that has cracked and peeled. This area is touched up with acrylic paint.

Right: After the touch up, the entire translucent area that is touched up is back painted with opaque silver paint. This allows the touched up areas to match in color and translucency (which is now not transparent!). The Liberty statue in the center of the circle is not touched up, and is left translucent.



Last Resort: Repainting an Entire Translucent Area.

As a last resort, you can remove ALL the paint from a transparent area, and touch up the entire area. This allows you to touch-up the area without having to worry about how translucent your colors are. In order to do this, you'll have to chip-out ALL the current color in that area. Use a hot exacto blade and score the outside edges. Then scrape out all the color from this area with a razor blade. When you re-apply the color, it will be very easy. Color matching will be far less of an issue. When done, make sure you remove the back box light bulbs from this area as they are no longer needed. Though this situation is not ideal it does work.

For example, on one game I had, the white translucent areas in the words "Game Over" was completely delaminated. Using an Exacto knife, I chipped out any of the remaining white translucent paint from the "Game Over" letters, so they were completely clear (the black masked, non-translucent area around "Game Over" was fine). Then I Triple Thicked the backglass. After the Triple Thick was dry, I masked off the area around "Game Over", and sprayed a light coat of white Krylon spray paint over the clear "Game Over" letters. This worked amazingly well, and looked great even with the backlit #47 light bulbs on. But the catch was the letters were translucent white only with no color.

Doing the Touch up.

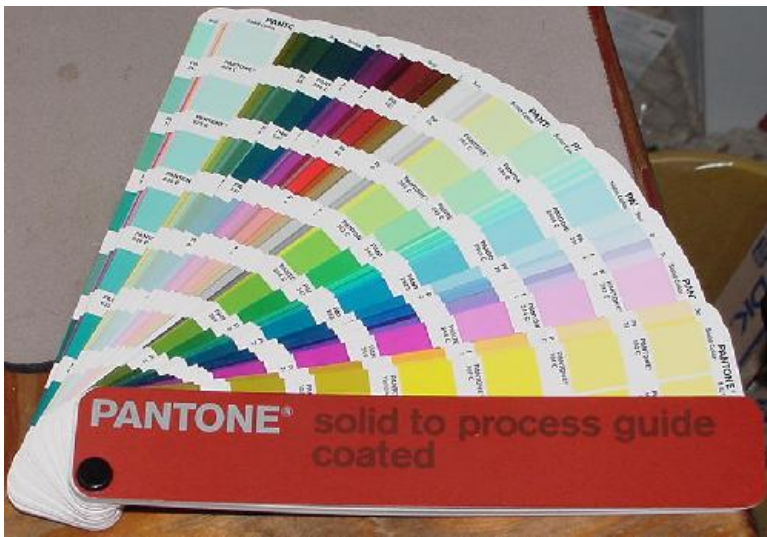
Step 1: Buying the Right Paint Colors.

There are probably 100 different colors of craft acrylic paint available. Obviously, you won't buy them all. But it's always nice to have colors out-of-the-bottle that match as close as possible the colors you need. So here's some tips on buying colors:

- Buy the brightest colors available, and some soft pastels. For example, it's easy to make red lighter by just adding white or by adding a softer red pastel. But you can't really make red more red, short of adding more red pigment.
- Buy at least two of each of these colors (a deep and pastel version): red, yellow, blue, green, purple, orange and brown. I also bought a flesh tone color too.
- Buy bright and off white.
- Buy black. You'll need it to darken colors.
- Buy silver metallic. You'll need this as a final color step.
- Buy acrylic paint retarder.

But in reality, the more colors you buy, the better you'll be. In the end, I bought nearly ever color my local store had to offer. Heck they had a sale on the acrylic paints, so it really was not that expensive. And it makes backglass touchup a lot easier. Taking color out of a bottle is a lot easier than making your own colors.

The Pantone Solid-to-Process color guide. I find this very useful for matching backglass and playfield colors.



Another tip I can offer is to buy a Pantone color matching set (get the solid-to-process version, as it can be used for doing computer color matches too). These are available on Ebay in the \$30 to \$60 range. It's a lot of money, but I find it very useful. If I don't have the right color for a backglass, I match the color on the Pantone color samples. Then I take the Pantone color swatch to the store and get the right color. This saves me from having to haul a backglass into the local store to get a color match! I also use the Pantone system for doing computer color matches when recreating artwork on the computer with Adobe Photoshop.

Step 2: the Black Lines.

Before you start applying any paint, you need to re-create the black lines that separate the colors. Not all areas will use these, but in the areas that do, this is your first step. I suggest using a NEW black "Sharpie" pen and a ruler for this. Draw the lines on the back of the backglass. Usually you'll have to go over the same line two or three times to get it really dark. If you make a mistake, use some alcohol and a paper towel to remove the Sharpie's ink and start over.

Using a Sharpie and a ruler to re-create the black separation lines the run between many colors.



There is a reason you don't use black acrylic paint for the lines. First, it's very hard to paint a straight, consistent line. Second, if you make a mistake applying color near the line, you'll end up removing the color mistake and the black line. Then you'll have to repeat painting the black line. The Sharpie's ink will not be removed with water when you have to re-do a color area.

Using the end of a paint brush to mix a bit of black into some green to darken it. This is done on a scrap of cardboard, on the shiny side to minimize water absorption.



Step 2b: If large sections of paint are gone...

If you are attempting a major re-paint of a glass that is REALLY gone, here's a tip. Use your Sharpie pen, and draw in the backglass design's outlines on the FRONT of the glass! When done, flip the glass over, and fill in the missing areas with colored paint. It's kinda like painting-by-numbers now. After that dries, remove the black Sharpie lines from the front of the glass with some Windex.

Step 3: Mixing the paint.

Now that the black lines are in place, you'll need to mix some paint to match colors on the backglass. This is the most difficult part of the entire procedure! Your ability to match colors will give the best outcome. I would highly suggest you have someone help you with this. A second pair of eyes and perception always helps. No

sexist comment intended here, but females seem to be able to help the best. They perceive color differently than males, and can often help you match color better.

Mix the paint on a piece of scrap cardboard or plastic. Note if you use porous cardboard, the paint may dry quicker on the pallet, as the cardboard absorbs the water from the paint. You can also use the top of an old margarine tub or mix the paint in a 35mm film container. Then just put the lid on, and the paint won't dry as quick.

Just squeeze out the colors from the bottles, and mix it with the end of your paint brush. Also have a glass of water and some paper towels nearby. When done mixing, wipe off the end of the brush on a paper towel.

I usually start with a darker color than I need. Then I add a touch of white or the same color pastel to lighten it. Alternatively, you can start with the light pastel color and add a dap of the deeper color or black to darken it. But be careful trying to darken a color with black. For example, adding a touch of black to green will make it darker, but it also makes the green "blacker" in the process, and not really "greener". It's much easier to darken a pastel with a deeper version of the same color. It's a lot easier to lighten a color doing the reverse. Add other colors as needed to change the overall shade of the color.

*Applying some test paint to your sample test glass.
The color on the left is the green straight from the bottle.
The color on the right is the same green with a touch of
black added to darken it.*



Step 4: Paint your sample glass and let it dry.

When you think you have a color matched, apply some to your small test piece of glass. If you don't have a test glass, just apply the mixed color to the FRONT of the backglass. Using the front of the backglass or a test glass is the best way to match the color. Let your sample glass dry (a hair dryer can be used to make the paint dry faster). The biggest problem with these craft acrylic paints is they dry darker. So let the sample dry, and then compare it to the backglass color.

Don't worry if your paint dries on the cardboard mixing pallet while you're waiting for your sample test glass to dry. Just dip your brush into some water, and put the brush on the dry paint. It will become liquid again as long as the paint has not dried for more than about 30 minutes.

To clean your sample test glass or the front of the backglass (for the next color), just use a paper towel dipped in some water.

Dark green applied to the backglass. Can you see the touched up area? The two black dots give it away. They are from not properly cleaning the damaged glass areas before applying the Triple Thick. I probably should have chipped them out with an exacto blade before applying the green touch-up paint.



Step 5: Apply the color to the backglass.

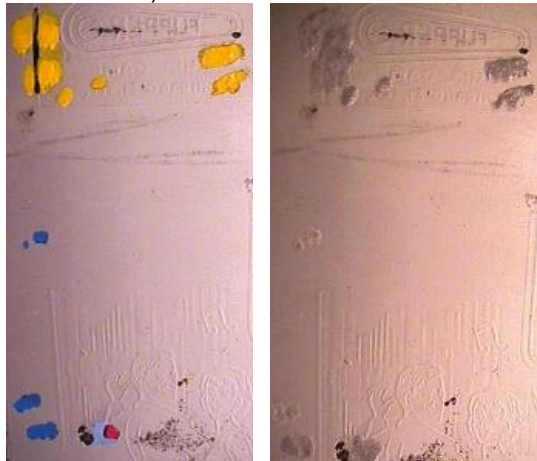
So you think you have the color matched correctly? Now is the time to apply it to the backglass itself. If you are unsure about where to paint the new color on the back of the backglass, use a black Sharpie on the *front* of the backglass to outline the area to touch up. Brush the new color on fairly thick, but try NOT to overlap the paint past the area it needs to go. Don't make a big mess here. Let the area dry and flip the glass over and check your color match.

Not Happy with your Work?

If you're not happy with your color match, just wipe off the applied paint with a wet paper towel. Now re-mix the paint and try again. This is the beauty to using the water-based acrylic paints. You can change your mind, and start over.

Left: the backglass after touch-up. You can see the color touch-ups and the black Sharpie line.

Right: the backglass after silver has been applied to the touched-up areas. This makes the touch-ups less apparent from the back, and makes the area less translucent.



Step 6: Re-silver your Opaque Touched-up Areas (optional).

This step is optional, but I recommend it if you are happy with your touch-up work. Nothing looks worse than inspecting the back of a backglass, and seeing all the touched-up areas. They stick out. Putting silver acrylic over these opaque areas makes the touch-ups far less apparent from the back of the glass. It has some effect on the front of the glass, in colors that are hard to apply opaque (like yellows). Adding the silver can stop additional light. Just dap some silver over the touched-up areas. Don't apply too much, and don't move the brush heavily while doing this. You don't want the silver to leach through the color applied before.

All Done?

Note that after the water-based acrylic dries for about an hour, you can NOT wipe it off! Once the acrylic sets and dries, it is more or less permanent. It will stay somewhat rubbery though, which allows it to be peeled up if needed. So if you made a mistake in the touch up process, don't let the acrylic paint dry too long before removing it. Goof Off can be used to remove dried acrylic paint though.

An Alternative BG "Touchup" Method for Translucent Areas.

A lot of people will see the above paint mixing and matching, and just do a head-bang. Yea it's a lot of work, and frankly the results can be poor if you're inexperienced or color blind (or both!) And also especially if you want to touchup the translucent areas of the backglass (which is very difficult).

But there is another less volatile way to do translucent backglass touchup. And it take a lot less time, is cheaper, and far less invasive. That's the good news. The bad news is it only works in the translucent areas of the backglass. For the non-translucent (opaque) areas, you will need to follow the steps outlined above using acrylic paints.

First step is to clearcoat the backglass with Krylon Triple Thick (if you have not done that already). This is *required*. The second thing is you much run #47 bulbs in the backglass (the #44 bulbs are too hot).

The next step is to go to Micheals and buy some translucent colored cellophane. This comes in a 24" wide roll 1mill thickness, and in a variety of colors. Red and yellow are the most commonly used colors. Cost is about \$6 per roll.

Another alternative to Micheals is to get some Rosco Gels (Roscolux.) These are basically the same as the Micheals stuff, but come in WAY more colors. You can buy a swatch of them for \$7.50 to make color matching easier. They are available from <http://www.rosco.com/sbreqs/index.cfm>. Also available is a kit with all most of the colors offered for about \$35 from [here](#).

Next turn the backglass over (screened side up), and cut a length of the transparent cellophane. On the red you will need to 'double up' the cellophane, folding it in half (for less transparency). With yellow cellophane you have to go even further, using at least 4 layers if not 8 layers (the yellow is far more transparent than the red).

After the cellophane is cut to the approximate size you want, covering the area desired, just Scotch tape it in place. I use a quality 3m tape as it's more durable, but anything will work.

Now install the glass in the game and turn it on. If the lights are "too bright", I often remove a couple bulbs to decrease the amount the light. This often really helps. This is not a perfect solution, but it's easy and non-invasive. And if you want to reverse it just peel back the cellophane.

Here's the red and yellow cellophane taped to the chipped areas of the translucent parts of the backglass. Note the backglass has been clearcoated with Krylon Triple Thick. Pretty ugly, but it works well.



Here's the same backglass installed and with the game turned on. A few #47 light bulbs removed to lessen the light, but the overall effect is much better (especially in the yellow "Jet Spin" lettering).



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