Blast It

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Part I

I built a dandy sandblaster about ten years ago that has given me trouble free service for a minimum outlay of money, considering the performance of the unit. Three of the components will take up the lion's share of the cost of the setup. If you are serious about building a sandblasting rig, then you probably already have an air compressor with good moisture control.

Another costly component is the "gun" which I will talk about more later. Finally, you will also need a big shop vacuum like the ones from Sears you always see on sale.

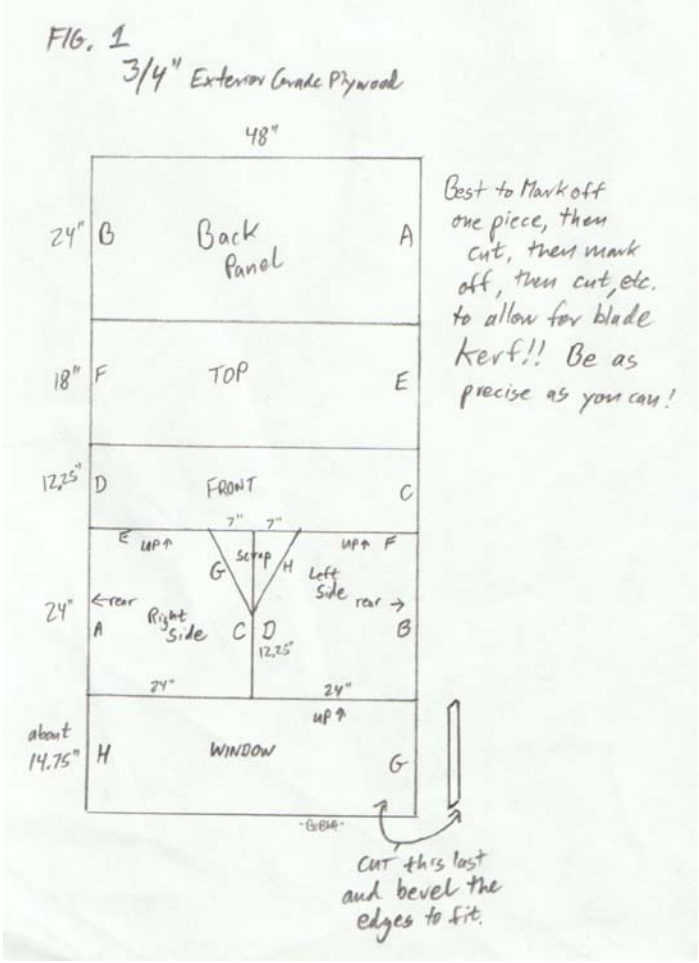
The rest of the stuff needed are a few sheets of 3/4" exterior plywood, a couple of two by fours, your scrap lumber bin and hardware bucket, a bunch of drywall or deck screws in various lengths, a couple of tubes of caulk and Liquid Nails, some used casters, a couple of hinges, a pair of rubber gloves, an extra left hand rubber glove (the right hand always gets a hole in it for us righties- lefties will need an extra right hand glove- either way it is the one that does not go bad on you so you will always have one lying around), a yard of remnant vinyl like the kind you would use on a seat cushion, some 1/4" steel mesh screen about two feet by four feet, a piece of screen the size of your viewing window like the stuff you have on your screen door, a piece of 1/2" electrical conduit, and a trunk latch mechanism from Menard's. Oh, you will need to get a piece of tempered safety glass made up for the window at a glass place but it is not too expensive, maybe 15 to 20 dollars.

Tools required are a circular saw, sabre saw, a drill with a tip to screw in the screws, a couple of typically sized drill bits, a hole saw of the same diameter as your vacuum hose, and some typical measuring tools, straightedges, pencils. You will need to access a sewing machine for a few minutes to sew the gloves to the sleeves you will make from the vinyl. You will also need to have about three minutes of welding done on the conduit or you could bring the pieces to me and I will do it for you.

I once drooled over the metal cabinet style sandblasting booths that I saw for sale in the TIP catalog that I sent for out of a Hemmings advertisement. But I drool no more. As a matter of fact, I let TIP drool over my booth. My old flight instructor (he was certificated in 1926) once told me that if you have a good wood hangar, it will absorb so much moisture from the air that you could spray dope on a rainy day without the dope blushing. The downside is that the wooden hangars burn real easy, especially with the dope fumes in them, and all the smokers smoke inside because of the rain. Anyway, I do know that the metal cabinets tend to allow the condensation of water with temperature changes in the air just like it messes with airplane fuel tanks if you leave them empty of fuel.

Moisture is the bane of all sand-blasters. It must be kept out of the air and the sand, otherwise you will get constant clogging which will cause you to repeatedly curse (and clean) the thing out. Imagine throwing cooked rice at a wedding instead of uncooked rice. That is what the difference is. Ten years ago, I chose to make my cabinet out of wood to take advantage of its hydroscopic properties. I believe that it is the big reason why it works so well for I have never had a clogging problem in all the years I have used it. Professional A&P Mechanics that have used my unit have sung its praises, some swearing it is the best unit they have ever used.

My intention is to publish a series of articles in the Chapter newsletter over the next few months detailing the design and construction of a sandblasting box that will measure about four feet wide, two feet deep, and



two feet high. The entire unit will be much bigger for it will have legs, a hopper for the sand, a light fixture on top, etc. Of course, once you see the thing on paper, you may decide to make yours bigger, or smaller, or otherwise incorporate (and share in this newsletter) your own ideas.

Either way, you will find life intolerable if you ever will have to part with your sandblaster. Hopefully, by next month, I will have a working word processor again and we can get on with the project.

ure 1 using a circular saw.

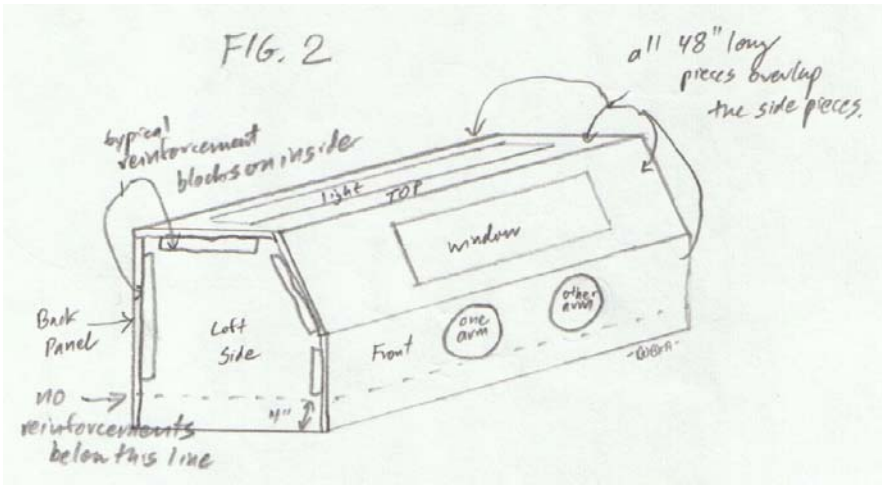
Assemble the box in alphabetical order so that letter A on the box side matches up with letter A on the back panel, letter B on the other box side matches up with letter B on the back panel, etc. The piece labeled top will overlap the upper edge of the back panel. Use scraps of 2 by 2, or similar lumber, at the joints but take care not to put any within four inches of the bottom edge for it will interfere with the rack that we will build and install next month. When together, it should look like the box shown in Figure 2.

Notice that the box will not have a bottom but all the other sides will be there. Use liquid nails or similar construction adhesive and drywall screws of a suitable length. The piece labeled window will need to have its long edges cut with a bevel where it joins with the top piece and the front piece. Best to cut this piece last. Try to make the box as air tight as you can since the sand will leak out of any holes you might leave.

Now orient the box as shown in Figure 2. Mark off the two 6.5" diameter circles (large coffee can diameter) shown on the piece labeled front with the centers 7.25" from the bottom edge and 9" either side of the vertical centerline. These are for your arms to hang into the box so if you are really wide, you may want to go with 10" either side of centerline, etc.

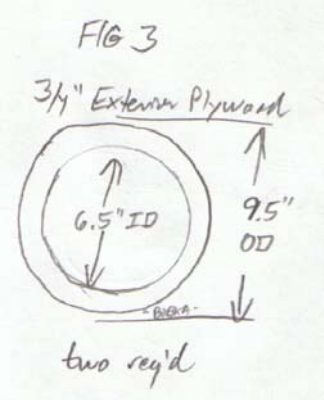
Likewise, mark off a 10" high by 22" wide rectangle to accommodate the 12" by 24" sheet of tempered safety glass that will overlap the hole by an inch all around (do not install the glass now, though). This rectangle for the window should be centered top to bottom and side to side on the piece labeled window. Use 1/2" drill to start a hole for a sabre saw to finish these cuts.

Take the rectangular piece that was scrap from this previous operation and mark off two wood donuts of 6.5" inside diameter and 9.5" outside diameter per Figure 3.



Part II

This is the continuation of the *Blast It* article that first appeared in the June newsletter. We will spend this month building the upper half of this custom built sand blasting cabinet. Obtain a sheet (you will ultimately need two so buy both now) of 3/4 inch thick exterior grade plywood and cut it to the dimensions on Fig-



Cut them out with the sabre saw/drill combination. These two donuts will serve as retainers for your glove gauntlets.

Mark off a 6" by 42" rectangle on the piece labeled top and cut it out with the sabre saw/drill combination. This is for light to get in. Purchase a piece of plexiglass that is larger than this opening and glue it down all around with some silicone. Later, you will place a 48" dual fluorescent eight dollar light from Menard's over this for lighting.

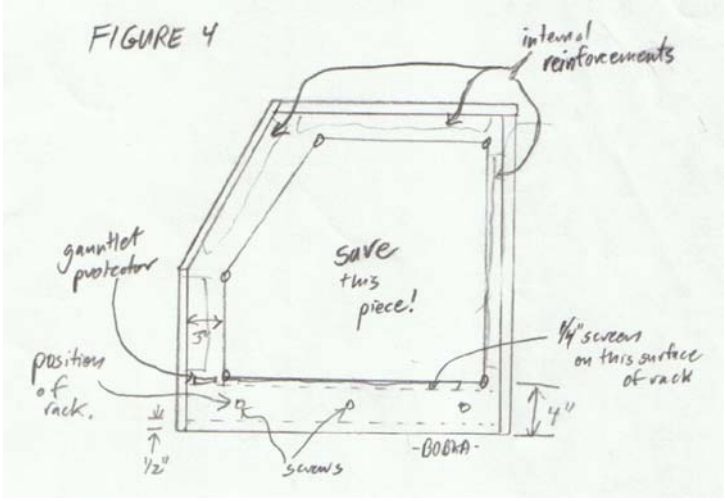
We have one last cut in the box which is the door for the right side but that will be for next month which is when we will also build the rack for the inside of the box and the hopper for the underside. Maybe we will even build the legs.

Part III

I have been hearing good feedback from all of you on this project. Interest level is high. I would appreciate any ideas you may have so feel free to call with your comments. Let us get going straight away. We last left off with the basic box completed and we were next going to cut the hole in the side for the door. I put my door on the right side but you can do what you want if the place you plan to put your box dictates otherwise.

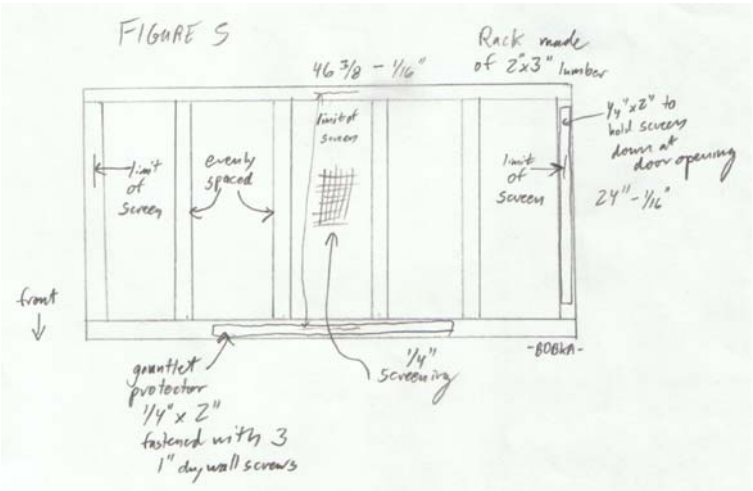
Figure 4 shows a roughly drawn side view of the box with the internal reinforcements shadowed in. Draw out your door on the side of your box so that the bottom edge of the opening is 4" from the bottom edge of the box. The front edge of the opening needs to be about 3" from the front edge of the box to accommodate the latch. The rear edge of the opening needs to be wide enough to accommodate the hinges you have decided to use (I used two old door hinges).

The remaining two edges need to be made so as to clear the reinforcing members inside the box. I cut my opening by drilling five 3/8" diameter holes at each of the five corners of the opening and then used the sabre saw to cut on the line between the holes. Save the piece you have just cut out.



Next, we will build the rack that will support the screen that will hold your work. Turn your box over so the bottom faces up. Measure the opening. Mine is 46 3/8" wide and 24" front to back. Construct a rack out of 2" x 3" lumber to fit your opening but make it slightly smaller by a 1/16" as it must slip into place without interference. Use liquid nails and long deck or drywall screws to hold it all together. Figure 5 shows the rack I made. Try the fit of the rack into the bottom of the box. It will need to go in so that the bottom edge of the box will be 1/2" below the bottom of the rack. Figure 4 shows the side view of the rack installation.

Pull the rack back out and get a piece of 1/4" mesh screen the same size as the rack and attach it somehow (I used a staple gun) to the surface that will face the top of the box. It is best to make the screen slightly under size because some day you may have to change it and you want to be able to get to the fasteners to pull them out. Put a length of smooth thin wood about 1/4" by 2" by about 24" long along the edge where the gauntlets will eventually be installed. The sharp screen edge will tend to cut into the gauntlets if you do not have this. Put another piece at the edge where the door opening will be. Go ahead and install the rack into the box using



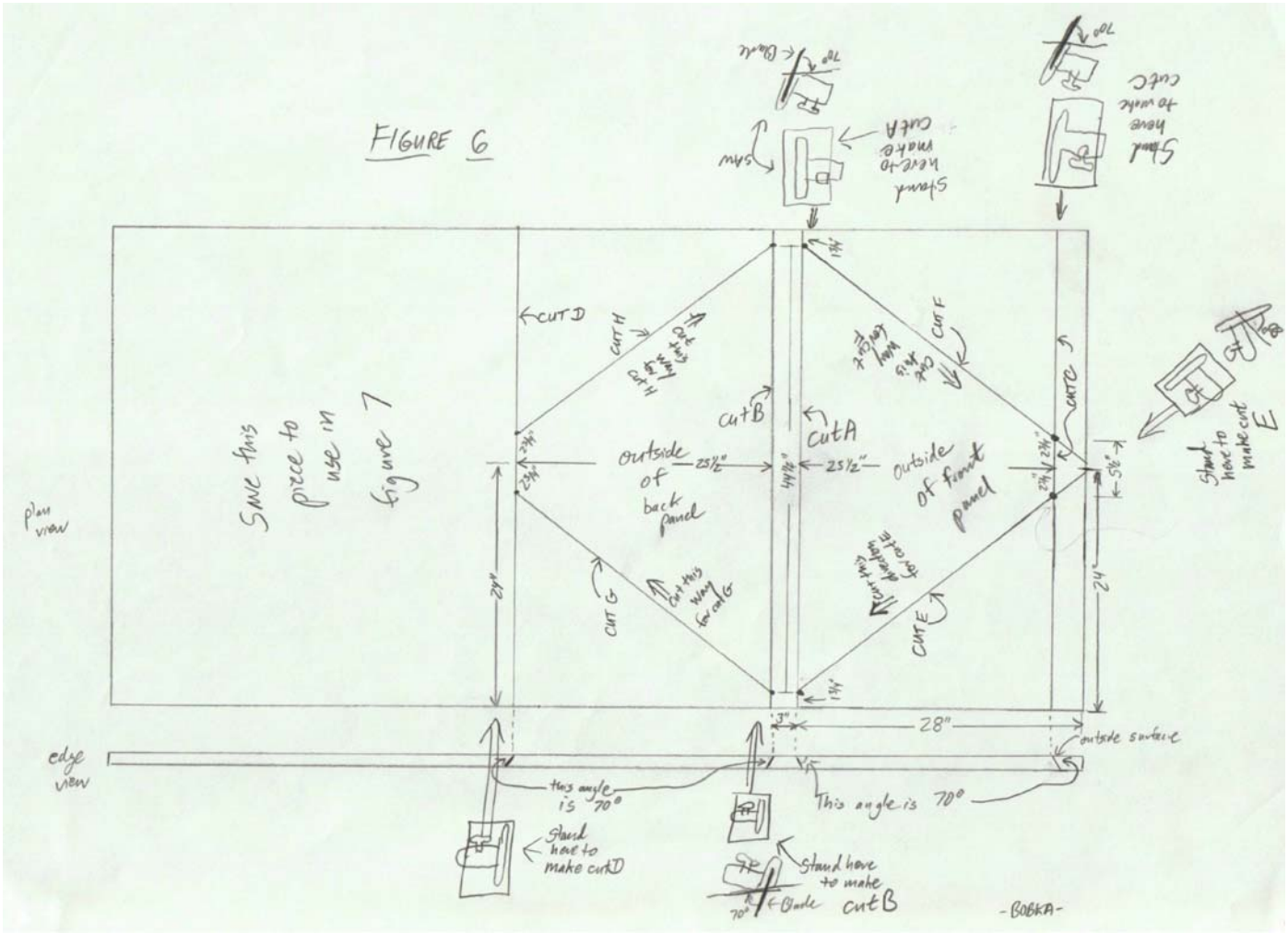
liquid nails and 1 1/2" long drywall or deck screws driven in from outside the box. Be sure that the rack is set into the box a 1/2". This lip will be needed to secure the sand hopper.

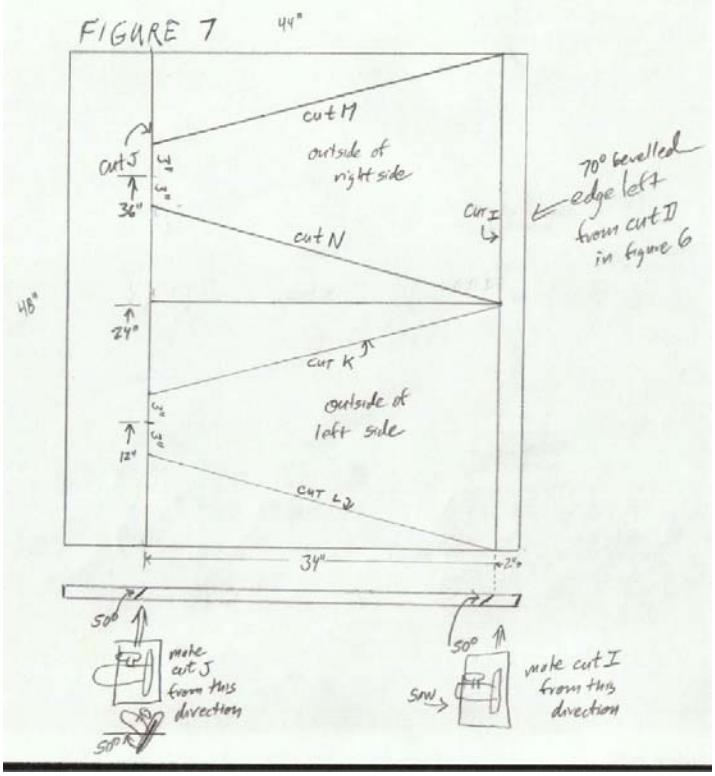
We will save the sand hopper for the next installment of this series. It requires the most complex saw cuts of the whole project so it will take an entire article to explain. In the meantime, it looks like you have a dandy cage for a pet rabbit!

Part IV

Today, we build the hopper. It is the hardest part of the sandblaster to make. The difficulty lies in the number of compound miter cuts that need to be made so that the hopper comes together without having to scrap a few pieces for miss-cuts. To keep things straight, I recommend that something be done to your remaining sheet of plywood so that you can positively identify one side from the other. If anything, I would prefer that you call one side, the ugly side that you might not want to see, the inside. Make the other side the outside. All marks and cuts will be made with the outside facing you. Time to conceptualize. What we are making is a pyramid that has the two sides smaller than the front and back pieces. This pyramid will then be placed beneath the rabbit cage you completed last episode. The angles that I give are for the 24" x 18" cabinet that I have provided the plans for. If you have made a different size cabinet, you will have to do your own calculations. It is important that if you deviate from the plans, you must ensure that the slopes of the sides are great enough so that the abrasive will roll back down toward the bottom of the hopper after it has done its job blasting. I can say that despite the appearance, the slope dimensions I am about to provide are just barely adequate. Steeper sides would be better but then you run into a ground clearance problem because you still will want to be able to place a bucket under the hopper so that when you open the hatch, you can empty out the hopper. That was what was limiting for me.

Layout the dimensions for cut A and cut B as shown on Figure 6. Set the circular saw to 70 degrees so that the acute angle is to the left of the blade and proceed to make the cuts. Note where I tell you to stand as you





start the cuts as this puts the 70 degree bevel facing the correct way. Use the edge view to double-check that the bevel is facing the correct way. Layout the 251/2" dimension from the edge where you made cut A and from the edge where you made cut B. Draw the lines for cut C and cut D. Make cut C and cut D. Again, be real careful that you make the bevel going the correct way as indicated on the edge view. If you stand where I tell you to in the drawing, you will not &*$% up.

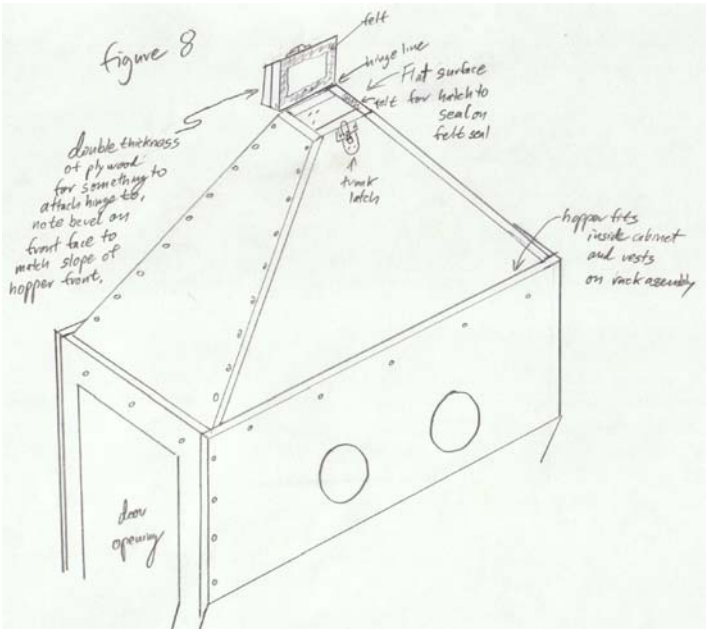
Now, layout the 441/2" dimension on each piece and the two 23/4" dimensions on each piece. Draw the line for cuts E, F, G, and H. Set the saw for an 80 degree cut with the acute angle to the left of the blade and proceed to make cuts E, F, G, and H. Note that as cuts A and B had the bevel on the finished piece facing away from you, cuts C, D, E, F, G, and H should yield the bevels facing you. This is all because of the complications of the stretched pyramid. You should be getting the idea by now as to where to stand to get the bevel facing the correct way.

This should complete the cuts on the front and back pieces. Stand them up against each other and they should be identical. If not, go to Menard's and get another piece of plywood and do it again but don't tell anyone. For the side pieces, we will refer to Figure 7 which utilizes the piece of plywood left over from Figure 6. This piece should be 48" by about 44" or so. Measure in about 2" from the edge left over from cut D and mark off for cut I. Set the saw so that 50 degrees is the acute angle to the left of the blade. Some saws cannot do this as the saw is limited to a 45 degree angle. This is ok but not preferred. Do what you need to do. Make cut I. Measure off cut J 34" from the edge where you made cut I. This dimension is purposefully generous as we can then still make a few cuts to make a close fit when we do a trial fitting of the hopper in another 10 minutes.

Using the 50 degree saw setting and taking care to put the bevel on the correct side, make cut J. Mark off for cuts K, L, M, and N. Reset the saw to a 90 degree blade angle (hooray!) and proceed to make cuts K, L, M and N. Flip the rabbit cage over. Get a helper and hold all the pieces together in the form of an elongated pyramid right on top of the rabbit cage. The hopper side pieces should overlap the hopper front and rear pieces. If you look back to Figure 4 in Part III, we mounted the rack with the screen so that it was recessed into the cabinet 1/2". The hopper should fit into this recess.

It may be necessary to trim the edges of the hopper pieces to achieve a good fit into the recess. Also, the side pieces should be a little long so mark off a cut on the skinny end (the highest), taking great care to remember which way the 50 degree bevel should go. Make these cuts. The end result here should be four sides coming together forming a small rectangular hole. The beveled surfaces surrounding the hole should appear flat and parallel to the floor allowing for a hatch to be mounted with a good sealing surface. Maybe if you can get your mitts on a handheld belt sander, you could true up this surface to make it perfect. See Figure 8.

If you are satisfied, then go ahead and glue the hopper together using liquid nails and some 11/2" drywall screws. As it is drying, fashion a hatch from some scrap plywood with a hinge on the rear side and a trunk latch on the front side. Mount it as snug as you can. I used machine screws and doubled up the nuts so they would



not loosen. Get some felt and glue it on (in layers if necessary) around the sealing surface until you can be confident it is really, really snug. You do not want any leakage here as you will have a big hourglass once the unit is upright and the abrasive is added. If you leave a hole and you put glass beads in the hopper, they will be on the floor the next morning. Do not attach the hopper to the rabbit cage yet as we will need to reinforce the inside and add some important hardware – the pick up tube. You cannot forget to put the pickup tube in. This will be discussed in the next episode. Have a good Holiday!

Part V

December's installment of Blast It! left off with the near completion of the hopper. It still requires reinforcements to be cut and glued/screwed along all the seams on the inside. I used two pieces of 2 by 4 that were cut to about 3/4 of the length of a seam where two of the panels come together. Using an angle finder to duplicate the angle, I set the table saw blade to match, set the fence for about half the width of the 2 by 4 (which is about 1-3/4 inches), and then ran the two 2 by 4s through the table saw so that I had a four pieces roughly 1-1/2 inches by 1-3/4 inches.

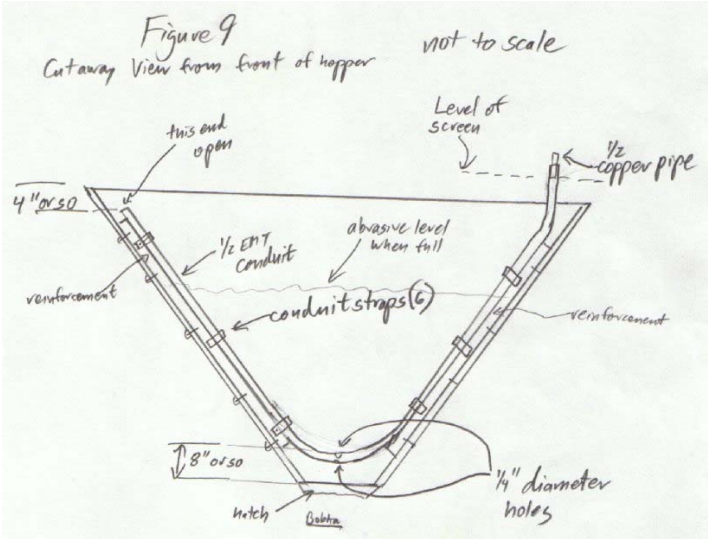
Importantly, these pieces will perfectly fit into each corner from near the top to near the bottom and help to keep the weight of the abrasive from pulling apart the hopper over time. Glue them to the inside, centered midway between top and bottom, with Liquid Nails or whatever and then run some 1-5/8 inch screws from the outside into these. While you are at it, caulk the uncovered seams on the inside of the hopper to keep abrasive from filtering through.

We next turn our attention to the construction of the pickup tube. Its purpose is to allow the sucking action of the gun's venturi to suck air through a V tube that is immersed in the sand. Some abrasive is added in the middle, it is accelerated by the air, and then it hits the piece you are cleaning. Imagine a V of tubing. One end of the tube sticks out of the sand to let air into it. A hole is drilled in the wall of the tube at the bottom of the V deep down in the sand so that the abrasive is pushed into the tube from the force of the weight of the abrasive piled on top of it. The other end of the V is connected to the blasting gun via a flexible hose.

Once the abrasive is in the tube, the air rushing through the tube toward the gun picks up the abrasive, accelerates it to hopefully match the speed of the air in the tube, and then proceeds into the flexible hose and then out of the gun to impact the piece you are blasting. To keep the air moving, keep the tubing diameter small.

To make the pickup tube, we use about an 8 foot length of 1/2" EMT electrical conduit. It costs a couple of dollars for a ten foot length at Menards or Home Depot. Keep it long so that you can be less critical on the place of your V bend. Take the tube, pack it with sand and then plug the ends with some soft wood. This will allow you to make the bends without kinking the tubing. If you have a hickey for bending EMT, then use that and you can also forget about the sand. At the midpoint of the tube make a bend so that it matches the angle of the V that the front panel of your hopper makes. It should be about 80 degrees or so but make it match real close. Also, try to keep the radius of the bend as small as you can.

Ideally, the bottom of the V should be within 8 inches of the bottom of the hopper. Do your best. Empty out the sand. See Figure 9. Hold the V inside your hopper so that it sits on the inside corners of the front-to-side panel reinforcements that I instructed you to install in the previous paragraph. Mark the tube about 4 inches from the top edge of the hopper. On the mark, cut the tubing off with a hacksaw or tubing cutter and use a deburring tool to keep from hurting yourself. This is the end of the tube that the air is sucked into. It should be on the left side of the box as you face it if you are a righty and, for you ex-Marines out there, on the right side of the box if you are a lefty. Take six conduit attachment straps and bend them so the strap closes to 270 degrees from the original 180 degrees. Using three to each side as we do not want this piece coming loose next year, attach the conduit with drywall screws to the front inside corners of the hopper reinforcements.

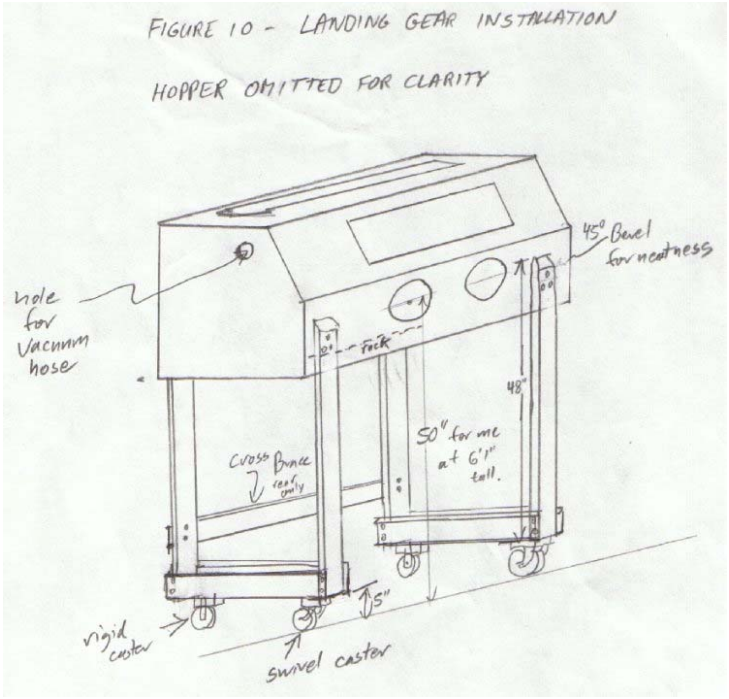


At the lowest point of the V, drill a 1/4 inch diameter vertical hole clear through both walls of the conduit. This is for the abrasive to fall into the tube. Now, eyeball your rabbit cage and take some measurements. We are trying to find the optimum place to have the V poke through the screen on the end that you attach the flexible hose that leads to the gun. Bend and tweak the conduit so that it stands straight up out of the hopper in such a location that if you were to fit the hopper to the rabbit cage, it would be 1/2 inch inside the front edge of the screening rack as far into the right corner (if you are a righty, left corner if you are a lefty) as you can get it. Cut it off so that it will stick up about an inch through the screening once the hopper is fitted to the rabbit cage.

Deburr the hole and then get a three inch length of deburred 1/2 inch OD (5/8 inch OD) copper plumbing pipe and pound it into the end of this 1/2 ID conduit tube so that it sticks out about 2 inches. Trim off the end a little if the pounding deforms it. One of the biggest frauds perpetrated on the American public today is that 1/2 inch EMT conduit is really 5/8 inch ID! So it will fit. Honest. I prefer to solder this joint so that it will not come off.

Down the road, you will stretch a length of 5/8 inch ID cheap clear vinyl tubing from the big rack of tubing at Home Depot over the copper to connect the pickup tube to the 5/8 inch nipple on the gun. If you use a different sized nipple on your gun, then step down the EMT conduit to fit the size tubing you need. Now, do a trial fit of the hopper to the rabbit cage again. Best to have the cage inverted on the floor and the hopper fitting down over it. This time, though, note the point where the copper tube hits the screen and trim a hole in the screen here. It is important that this hole is far away from where the holes for your gauntlets will come through the front of the box as any screen wire that can poke holes in the gauntlets will ruin them quickly. If you are happy, then lay a bead of Liquid Nails all around the perimeter of the hopper-to-cage contact point, lay the hopper onto the cage, jump up and down on it to press it on tight. If you have to, hold onto a track for the garage door so that you do not fall and hurt yourself.

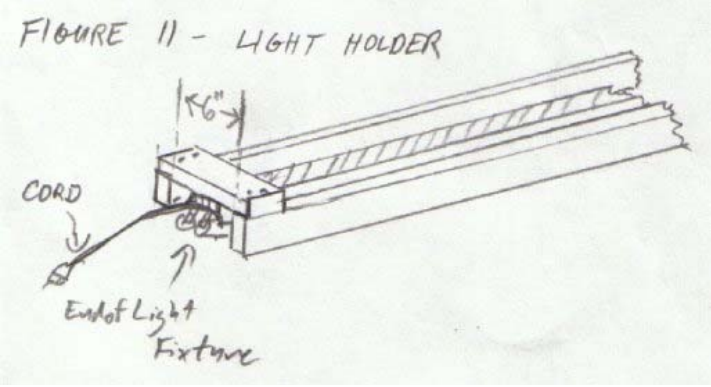
Make sure no one opens the door while you're doing this. Use a bunch of long drywall/deck screws to supplement the glue. Make sure these screws are installed well away from the thin edge of the hopper and penetrate well into the rack material. They should go in almost vertical. Make an airtight seal here. Supplement it with caulk if you need to. Remember that the weight of the abrasive must be supported by this joint. It is starting to look like something now. Next installment, we will add the legs and tidy a few more loose ends. We are almost done!!!

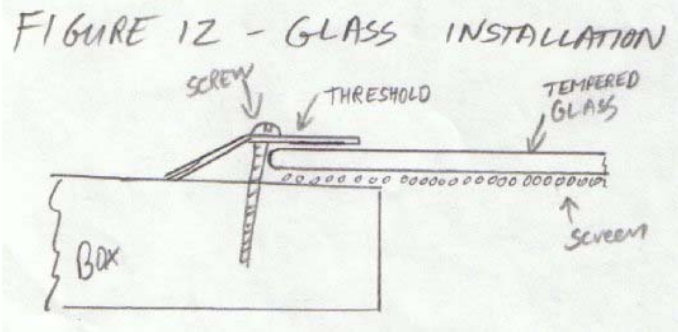


Part VI

The last installment of this series appeared in the February newsletter. As my hangar construction project has been taking up the lion's share of my time these past few months, I extend an apology for not continuing this series on the every-other month timetable. We left off in the last installment with the hopper attached to the main part of the box. We now need to install some legs and maybe some casters depending upon your preference. It is important that the holes for the gloves are at the appropriate height for the user of the sandblaster. I am 73" tall and I have the holes for the gloves set at 50" above the floor. It's a lot better to make the unit stand too tall where someone who feels short can stand on one or two pieces of wood to adjust his height upwards. That way, if someone who is tall wants to use the box, he will not have to bend his knees to use it. That would be very fatiguing.

Another major consideration is that the hatch on the hopper is high enough to get a bucket under it so that the abrasive can be drained out. Figure 10 shows how I installed the landing gear on my box. Boy, this draught Guiness is good!!! So is the Grateful Dead I am listening to to get "inspired" to write!!! I am not going to go into too much detail on the landing gear installation other than to say that I used two-by-fours and 5/16"





hardware with washers to spread the crush load on the wood. Remember that the box with the sand will weigh a few hundred pounds so make it stout. I used rigid casters in the rear and swivel casters in the front. You may wish to change this configuration to suit your desires. The holes for the bolts that attach the legs to the box should all be drilled so that they are above the rack so that you can get the washer and nut onto the backside.

Referring to Figure 11, we will next construct a holder for the lighting. I used a cheap eight dollar 48" twin fluorescent shop light fixture, readily available at Menard's or Home Depot. My holder was made from two-by-four lumber cut and screwed together appropriately to fit the fixture. Part II of this series had you cut out an aperture for light to get into the top of the box. A piece of plexiglass was then siliconed into place. My light fixture and holder assembly is screwed onto the top of the plexiglass on top of the box with machine screws and blind nuts so that it can be easily removed to service the bulbs. Do not encapsulate the top of the fixture, especially in the vicinity of the ballast, as it is necessary to allow the metal to radiate heat away. Going back to Figure 10, use a hole saw of a diameter to match that of the outside diameter of your vacuum hose to drill a hole in the position shown. My Sears shop vacuum uses a two inch diameter hose.

I admit here that the one problem I have with my box is that it seems to suck too much of the grit into the vacuum. It is preferred that the grit return to the hopper. Ron Hoyt has furnished me with an article from the December 1999 Machinist's Workshop magazine that describes a cyclone separator that might be successfully adapted. I would think that one or a series of baffles on the inside of the box designed to use the inertia of the solids to adequately separate them out could be designed. I will await input from the readers to figure this one out. In the meantime, I will just buy more sand, it's cheap.

Part II of this series mentioned the need for a 12" by 24" piece of tempered glass for the main window. Go ahead and purchase this now. A glass place is where you need to go. It is imperative that you use tempered glass. Enough said. I used some threshold from the carpet and linoleum department at Home Depot as a retainer for the glass. It is already drilled for screws and even comes with the screws. Miter the corners to make it look good. Make sure that the screws do not touch the glass as they will eventually cause a crack if they do. I also use some screen door type screening so that the grit that bounces off of the object that you are blasting hits the screen before it ever gets to the glass. Although the screen will cut down the visibility a little, it will greatly extend the life of your glass. The glass installation will require some caulk to keep it airtight.

That is enough for this installation. The final installment will cover the door installation, choosing the right "gun," what type of abrasive to use and general tips on its use.

Part VII

This installment will deal with making the gauntlets. The function of the gauntlets is to provide a soundproof, flexible way of allowing your hands into the box so that you can hold pieces that are to be blasted and to hold the blasting gun. Go to your favorite store that sells rubber gloves and get a pair of rubber gloves that have the thickest rubber with cloth impregnated in the rubber. They also should not have an elastic band but should taper with the largest diameter at the opening.

Obtain a piece of upholstery vinyl at a fabric store. A yard should be sufficient. Measure the circumference of the opening of the gloves and the circular opening in the sandblasting box. The gloves are about 8 to 10 inches long and the depth of the box is about 24 inches. You really need to be able to pick up stuff anywhere in the box, so a gauntlet/glove combined length of 24 to 26 inches is reasonable.

On the back side of your vinyl, use a magic marker and lay out a convex arc with a length equal to the circumference of the glove plus an inch. Likewise,

about 18 inches away from the arc, draw another concentric convex arc of a length equal to the circumference of the circular cutouts in your box plus an inch. Draw a line to connect the left end of the small arc to the left end of the big arc. Do the same for the right ends of the two arcs. What you should now see is a cone that has been laid flat and with the top lopped off. Cut out the shape that you have drawn. Fold the vinyl back on itself, good sides facing each other, so that the the two lines are back to back and sew with a double stitch along this edge.

Take the cone that you have created and hold it with the big end down. Take your glove with the fingers pointing down and slide it up inside the gauntlet until it is even with the top. You may have to trim the gauntlet shorter if the glove is bigger than the gauntlet. If the gauntlet is bigger than the glove, then go back to the sewing machine and add another line of stitches so that the diameter of the gauntlet is reduced. When you have a good match, sew the glove to the gauntlet. When done, turn the gauntlet inside out so that the good side of the vinyl faces out and you should have what looks like a glove that goes all the way to your armpit. Make another glove/gauntlet for your other hand.

The first installment of this series told of the need for an extra rubber glove for the hand which you will use to hold the piece to be blasted. If you are a righty, then you need a left glove. The kind that work best here are the type that have the elastic band. Try to find one that has the thickest rubber possible. Put your hand into the left gauntlet/glove and work this extra glove onto the gauntlet/glove until it fits properly. It will be snug but you really need a claw to hold the pieces. Flexibility is not too important. But it is important that you have this extra glove as it will prolong the life of your gauntlets immeasurably.

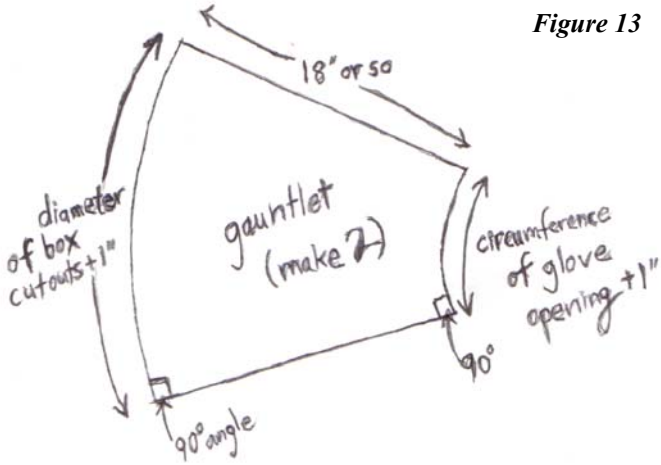
Don't do anything stupid...

If you should not use this extra glove, you will blow a hole in your gauntlet/glove which is much lighter in weight. If you should sandblast your bare skin..... ouch!! We will install the gloves in the next installment.

Part VIII

This series was discontinued after the seventh installment when son number two began to walk! That also coincided with David Kujawa leaving the chapter newsletter editorship and taking over editorship of Sport Aerobatics magazine and moving away to Arizona with his lovely wife, Diane. Instead of looking forward to dropping off articles at David and Diane's and sharing a few beers, I was fraught with fear at having to bring articles to ugly Pete and Bob. I hope you can find me some forgiveness for leaving you all hanging. So sorry. Much prodding on the part of Pete, Greg, FrankH, and others from the Pietenpol chat group has gotten me back to finishing off the series with this final installment.

Figure 13



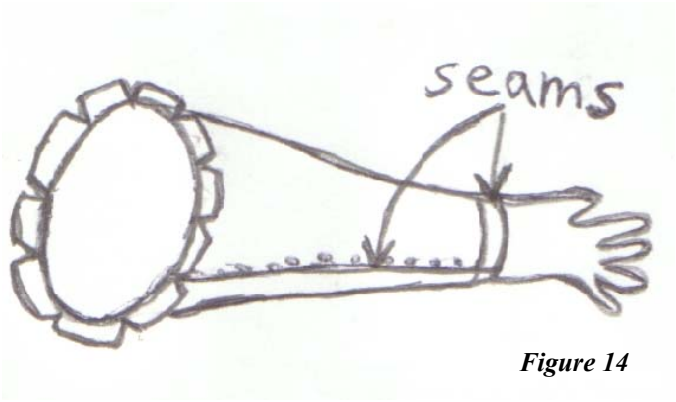
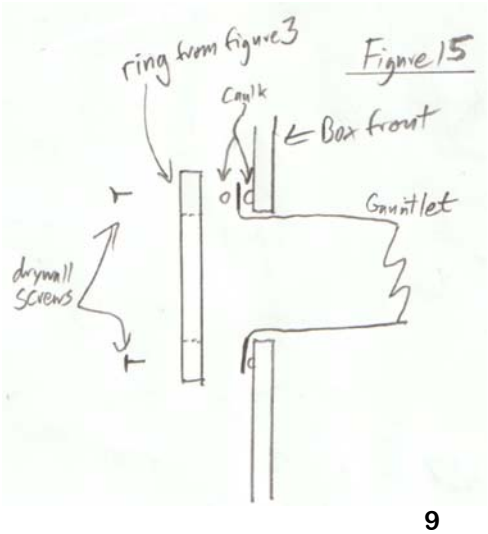


Figure 14

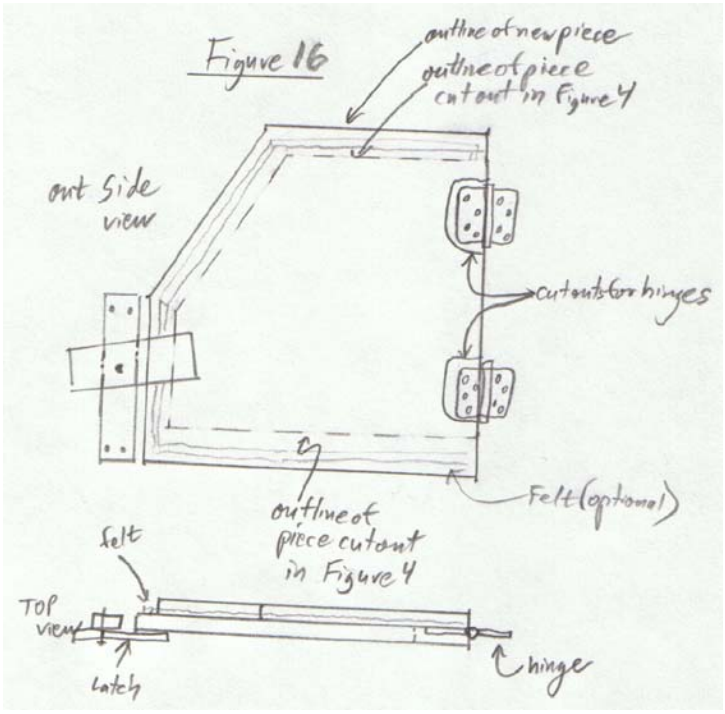
We left off with the gauntlets ready for installation to the front of the box. I have included Figures 13 and 14 which show a cutting diagram for the gauntlet and what the finished gauntlet should look like. As shown in Figure 14, cut some darts into the big end of the gauntlet to help it lay flat as shown in Figure 15 (see p. 4). Put some caulk around the left opening in the box and, using a heavy duty stapler, shoot some 1/4" staples into the box around the circumfer-



ence of the glove to hold it in place. Don't do what Norm did so make sure you use the left handed gauntlet in the left hole of the box and make sure you orient the thumb so that it is at about the 12 o'clock position. If you put the wrong gauntlet on that hole, you will have to stand on the ceiling in order to sandblast. Like Norm. Put more of the caulk on top of the gauntlet and then take one of the rings from Figure 3 and use enough 1-1/4" drywall screws to hold the gauntlet in place. You can clean up any of the squeezed out caulk at this time. Install the other glove. Thumbs up!

Next we need to install the door. You cut out the door opening in Figure 4 and at that time, I instructed you to save the cut-out piece. Go get it. Have an assistant hold the cut-out piece in the door opening. Take two old door hinges from the junk box and mark off the screw positions on the door and on the frame to the rear of the door. Ensure that the hinge pins lie directly over the cut line and the hinge lines are in line with each other. Now take the door piece and lay it onto another piece of plywood that is bigger than it. Mark off the same general shape but about 1-1/2 inches all the way around it EXCEPT for the rear edge. This mark-off should be even with the rear edge of the door so the door can swing open.

What we are making here is a piece of plywood that will overlap the door jamb so as to contain the direct blast of the sand. With your radial saw, cut out the new piece. As the hinges on the door must lay in the same plane as the box, it will be necessary to make cutouts to allow this new piece to clear the door. Cut these out with a sabre saw. The top and side views of Figure 16 clearly show this. You may design a better way and I know that there are better ways but this is the way I did it. Go for it! Make the latch as shown in Figure 16 from some scrap plywood. Attach the door and latch to the box. If you want, you can get some felt weatherstripping about 1/8" thick and 1/2-3/4" wide and put it around the door jamb as indicated to help contain some of the sand. An 1/8" looks thick but it will compress right down.



Well that is it. The box is done. Now we have to come up with the gun. You want a good one. The reason is that the gun uses air that passes through a venturi in the gun to create suction which pulls the sand up from the hopper, through the feed tube, and through the venturi itself, accelerating the sand along the way. At the venturi, the sand makes a sharp turn before it exits the nozzle. My dad, the physicist, says that force times mass equals impact. We want impact as that is what does the sandblasting. Mass is related to the size and density of the particle. Force is the effectiveness of the gun at accelerating the particle. Every particle of sand that comes out of the gun also is trying to wear down the venturi of the gun. A cheap ceramic nozzle coupled with a soft steel venturi will not last long as the sand will abrade it right down and the venturi will no longer be properly shaped to create a quality vacuum (if a vacuum sucks, is it good or bad?). Lots of air will come out of the nozzle but no abrasive. Then you will blame me that the sandblaster does not work. We need space age materials. We need titanium. We need carbide.

So I will tell you what gun to get. It is shown in Figure 17. It is available at Grainger, among other places, and can be found on the internet as of February 2003 at:
http://www.grainger.com/Grainger/catalogpageview.jsp?xi=xi&CatPage=1427 You want model 3JT01 for the 12 CFM model. It lists for a whopping 77 dollars but buddy Jim Markle at jim_markle@mindspring.com has agreed to purchase these guns from Grainger at his substantial discount and have them drop-shipped to interested buyers. The best thing is that parts are available too as listed on the same web page.

The gun does not have a trigger. You do not want a gun with a trigger. A gun with a trigger takes up too much room and your finger gets tired holding the trigger. Instead of a trigger, I merely connect and disconnect a Milton coupling right at the aft end of the gun. You could get fancy and use a foot pedal air

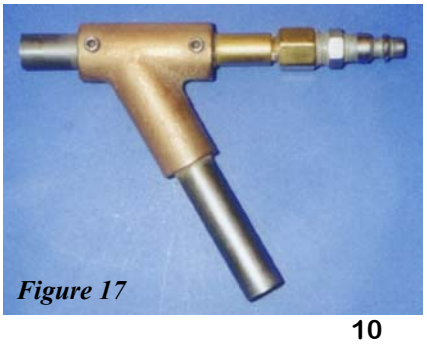


Figure 17

switch or you could put a valve at the point where the air line goes into the box. Use what you think you would like.

Once you have your gun, attach it to the end of the pickup tube inside the box with an appropriate length of 5/8" ID cheap clear vinyl tubing from the big rack of tubing at Home Depot that I told you to get earlier. Use some hose clamps to hold the hose on at both ends. Drill the smallest size hole you can get away with to let the air line into the box. It should be located near where the pickup tube is located so that both hoses can flop around more or less together.

You need a vacuum cleaner of the big shop vac variety. This is a necessity as you are creating a mammoth sandstorm inside the box. Without a shop vac, it will be so cloudy inside the box after a minute that you won't be able to see your hand in front of your face. You are pumping air into the box at 100 PSI and at 11-15 Cubic Feet per Minute. All the air has to go somewhere. If there is no shop vac then this air will blow out through every seam and put dust all over the garage and make a big mess. It will also go into your lungs and you will contract silicosis and die a horrible slow death. The key is to create a negative pressure inside the box so that the dust is trapped by the filter of the shop vac. Better yet, use an extra long vacuum hose and put the shop vac outside as even the filter on the shop vac won't trap all the fines.

There are endless varieties of abrasives to use. I use number five white silica sand. You can remember number five as that is how many fingers you should have on one of your hands. It is the same stuff that you see in sand-filled ashtrays next to the door to elevators in office buildings. Many sandblasting supply outfits are reluctant to sell you sand for sandblasting because they are afraid you will not be using proper breathing protection and they will be sued by your heirs after you die of silicosis. If you tell them it is for ashtrays, then they will chum right up and gladly sell it to you. It will come in 50 or 100 lb sacks. 100 lbs should do for starters. Dick Navratril, a Pietenpol builder here in the Twin Cities area (horzpool@goldengate.net), says you could also try a larger swimming pool dealer to get sand. In his swimming pool supply shop, he carries red flint granite sand sized at .45-.55 mm. It is rather aggressive but doesn't dust nearly as much as white silica sands. Some may try to use glass beads or walnut shells. It all depends upon the finish you wish, the aggressiveness of the cleaning, and the price you are willing to pay.

You may consider building more than one sandblasting box. Each can have a different abrasive. It is difficult to change abrasives from big to little for the following reason: you will probably never get all the big stuff out. What will happen is that you will make a change from big particles to little particles. You will think you have it licked and you will be blasting away looking at the fine, uniform finish on your blasted piece. Just as the ten millionth particle comes out of the nozzle, a stray big particle will come out, and whamo! there appears what will look like a huge crater in your work as that single particle hits. It may not bother you and it may not matter based on the part you are blasting but sometime it may matter. Again, the choice is yours. Once my new hangar is done, it will sport a couple of blasting boxes each with a different abrasive.

Additional abrasives management discussion is outside the scope of this article. I am sure that industrious users of their new blast cabinet will seek out information on http://www.google.com for more information.

A few tips on use are in order. All the debris you blast off of the pieces you are sandblasting will fall down into the sand. Eventually, they will migrate to the bottom of the hopper as it becomes their "turn" to be sucked into the pickup tube. Large pieces of debris will clog the venturi of the gun. The short term fix is to hold your free hand over the discharge nozzle of the gun, forcing the compressed air down the hose abrasive supply hose and the pickup tube and blowing all the junk out. This will work for a while but sooner or later you will have to empty the abrasive out the bottom of the hopper and sift it. I use a big sifter from the cookingware aisle of the supermarket that looks like a bowl made out of screening. This is the long term fix.

Use a pair of pliers kept in the box to hold small parts so you are not always blasting away at the fingertips of your gloves as you hold parts.

The box makes for really good storage of parts that must be kept rust free. The large quantity of sand acts as a desiccant to keep the air in the box dry.

You can also experiment with different air pressures. 50-60 PSI works good for most work. It is hard for many air compressors to keep this up at 12 CFM so from time to time you need to give the air compressor a chance to catch up. Also, most air compressors have a duty cycle which means that it is expected that a certain percentage of the time, the air compressor should be off and resting. It cools when it rests. You may consider a supplemental fan blowing on your air compressor to keep it cool.

Do not take stuff out of the blaster unless you have gloves on. The pros say to use surgical gloves. Oils and acids from your skin will cause the part to rust, even under paint.

As stressed in the beginning of this series of articles, moisture is the bane of all sandblasters. You must have adequate moisture control in your system. The ideal air

Figure 18

supply system uses many feet of metal, not plastic or rubber, air line between the compressor and the sandblaster. The metal absorbs the heat from the compressed air. As the compressed air cools, the water in it will condense out and deposit, in the form of water droplets, onto the inside surface of the cool pipe. As the air passes through the pipe it will roll these droplets along until they hit a moisture trap that will inertially snag them and keep them from traveling further. It is important to note that moisture traps trap water droplets, not water vapor. Putting a moisture trap at the compressor outlet will not do much good since the air will carry mostly vapor here as the air is so hot. The best "final" moisture trap I know of is the 1/2" coalescing air filter as illustrated in Figure 18 and sold by Tip Sandblasting at 1-800-321-9260. It uses a roll of toilet paper inside the unit to absorb all remaining moisture after the air has traveled through the standard inertial moisture traps of your system. The price is up there on this unit but the performance is spectacular.

Finally, as you sandblast and between sips of Guiness, USE PROTECTIVE BREATHING EQUIPMENT APPROPRIATE FOR SANDBLASTING. If it is good for wearing while doing drywall work, it should be good for sandblasting but read the labels on the devices you might want to use! Also, use hearing protection if you have the shop vac next to you. Ideally you can use a Walkman and its little earplug type earpieces under your hearing protectors so you can listen to the Grateful Dead as you blast away.

Jim Markle has posted ten pictures of his box on the following website for viewing.

http://www.shutterfly.com/osi.jsp?i=67b0de21b3322ee6e4b7

Good luck with your new unit and try to imagine how life was before you had it!

Powder Coating

by Christian Bobka **ATP, CFI, A&P and EAA Technical Counselor**

Article from Issue #64, BPA Newsletter

Here is a way you can paint all your small airplane parts inside the house without incurring the rath of those you share your living space with. The technology is the well known, but rather mysterious, powder coating process.

Progressive, master craftsman, Pietenpol builder **Dale Johnson** received a great Christmas gift from his wife last year. A terrific spouse, she has long ago learned that the more tools Dale has, the easier her life seems to be. The system she gave him is of the HotCoat brand which is marketed by Eastwood Tools. Call 1-800-345-1178 for a really good free catalog or check their website at http://www.eastwoodco.com for more info. They sell the kit for $149.99, which is reasonable when you consider the results and all the new friends you will have. Dollar for dollar, no other tool will get you more new friends unless you have a TIG welder and can weld aluminum. Canny homebuilders will probably uncover a similar system for any even lower price.

We have heard of the benefits of the powder coating process. It is more durable than conventional paint and is extremely resistant to chips and abrasion. It can be exposed to heat up to 350 degrees F. In the fuel and nasty chemical department, it is equivalent to the polyurethanes and epoxy paints that we are more familiar with

but does not have the drawbacks of the poisonous nature of these other types of paint during their application process. For those of you that find it hard to paint anything without screwing it up, it applies easily and uniformly without runs drips, sags, or solvent odors. In fact it is odorless and wins clean air awards all the time. It is easy to clean up by sweeping or vacuuming up the oversprayed powder. The applicating gun is blown out with clean compressed air. How many of us loathe the thought of getting a spray rig set up just to paint a few small overlooked pieces of our project?

None of that with this system. If you have twenty minutes of time and a preheated oven, you can paint a batch of parts. It is environmentally friendly in that no hazardous materials are consumed anywhere in the process and disposal is not a problem. It is economical in that unapplied powder can be removed from the gun and put back in the can so there is no spoilage like there is with equivalently durable epoxy or polyurethane paint. There is a wide selection of off the shelf colors to include black wrinkle finish for instrument panels, transparent candy type colors, and metallics.

Powder coating is a simple process. For starters, the part to be painted must be metal, able to withstand the 400 degree curing temperature, and be cleaned really well - no cleaner or dirtier than is required if you were to use a regular type of paint and expected a quality result. Sandblasting or glass bead blasted parts are ideal but not necessary. Parts can also be wire wheeled or chemically cleaned in cold dipped cleaner (CDC a.k.a. carburetor cleaner) available at auto part stores. A wipe down with a solvent like acetone is done just before the piece is racked (hung with a small piece of wire from the ceiling or whatever) for receiving the powder. No finger prints are allowed here. Although not totally necessary, a savvy builder looking for a super clean part with its resulting super high quality flawless finish, will bake the cleaned part in the oven to boil off any undetected oils and other contaminants. The part would then be allowed to cool before proceeding to the next step.

The part is hung up, and then grounded with a wire that attaches to a power supply which puts out high voltage but really low current (so you will not electrocute yourself). The other wire from the power supply connects to the gun. The gun has a powder cup/mixing chamber to which low pressure air is supplied. It is in this chamber that the turbulent air whips up the powder into a dry mist which is then negatively electrostatically charged by the current coming up the wire, and then is lightly blown out the nozzle. The powder particles "look" for a positively charged surface, "see" the positively charged part that is attached to the power supply with the grounding wire, rush over to it, and cling to it with pretty good force, I might add, and even after the power is shut off.

Once the powder is on the part, the part is transferred to an oven preheated to 400 degrees. The part must be able to hang inside the oven without the powdered surfaces touching anything. In other words, the limiting size of the part is the size of your oven. The part stays in the oven for 15 to 20 minutes and then is removed to cool. An hour after the part is removed from the oven it is ready for service. And the results are spectacular. The instructions that come with the system do not recommend using an oven where food is prepared, so the simple way around this is to find one that was removed and discarded for a kitchen remodeling job. Bachelors can get away with using the oven in their kitchen since the microwave is used exclusively in their homes. (So that is why I have an oven in my apartment!!)

Dale's setup in his back yard shop consists of a regular old kitchen oven that he was given by a friend. A gas or an electric oven, even a toaster oven, will do as long as it can hold the temperature at a reasonably stable and repeatable 400 degree temperature. The low pressure supply of compressed air needed is only about 5 to 8 psi.. If one did not have an available air compressor, one could use a refillable air tank or a couple of old tire/rim combinations from a junkyard that have been filled to capacity. My big Jeep tires can go to 55 psi and they hold a lot of air. Rolling Stone magazine contributor Hunter Thompson filled his Cadillac tires to 100 psi in Fear and Loathing in Las Vegas but you can do this at your own risk He claimed to have "experimental" tires so we share a common bond as we have experimental airplanes. Hobby shops carry adapters (made by Badger, makers of airbrush equipment) that allow an air line to attach to the valve stem. Hobbyists have used this trick with their airbrushes for years.

Dale has a 2 foot to a side box with a side removed that he uses as a "spray booth". Its size helps to gauge what he can fit inside the oven: if he can hang it in the box, he can hang it in the oven. The box has a small diameter rod across the inside top that is grounded to the power supply. He then hangs the parts to receive the powder from the rod using short bent up pieces of wire as hooks. He keeps the points of contact clean or replaces the hooks often as the paint collects on them through repeated trips to the curing oven. The hooks facilitate easy part transfer to the oven since he holds the hook, with fingers or pliers, instead of the part dur-

ing the transfer. It is not necessary to rotate the part as the electrostatically charged powder will race around the back of the part in search of any oppositely charged surface. Slick, eh? Overspray, and thus waste, is minimized since all the powder floating in the air will attach to the part making this system cost effective.

Of course, more than one part can be done at a time. You are limited by the size of the oven and the time it takes to get all the parts inside. Doing many small batches is not a problem as you get a rhythm going: clean, spray, bake, cool, clean, spray, bake, etc.. Dale has already given thought to making a larger oven that could be used for long parts, like his straight axle and wing struts.

A simple test can be performed to determine that the applied powder has properly cured after its trip to the oven. If you take a dull #2 pencil point and try to press it into the cured paint, it should not penetrate. If it does, then it is not fully cured and should be put back into the oven for a little more time. Commercial powdercoating establishments typically use an infrared heat source in their oven. They are trickier to use and items cured with them should be tested in the above manner. Curing in the 15 to 20 minute time recommended should not be a problem with a conventional oven unless the part is so big that it will take a bit longer to come up to temperature. Dale hopes to do his Continental A-65 crankcase using powder coating and will undoubtedly need to keep it in the oven a little longer because of the case's mass.

There is a powder coating establishment near the airport in Texas where I still have a hangar that has an oven big enough for an entire Aeronca fuselage. Talk about a good deal. Although his primary customers are lawn furniture manufacturers, the proprietor of this place does airplanes all the time. First, he will sandblast the fuselage. Then he gives you the opportunity to inspect the fuselage and haul it back to the house for any weld repairs that show themselves during the blasting. Back to the sandblaster for one more cleanup and then it is into the oven to boil out any stray oils or other contaminants (this is the key to a good job on a welded tube fuselage). The oven cools down and then the painting rig is brought in and after about 15 minutes of spraying in one of a zillion colors he has available, the rig is rolled out and the oven is back on again. Two hours later you bring it home and it looks good!!!! How much for all this in 1998 dollars? $350 and he warranties the work. That is not bad considering that in 1986, I had my Taylorcraft fuselage sandblasted for $200 and then I had to buy and apply the epoxy primer and paint for another $100 and I supplied the labor. It took days.

There have been rumblings in Sport Aviation, and other publications, that powder coating should be frowned upon for use on tubular fuselages, and other important welded steel assemblies because cracks could exist in the steel under the paint, that the paint would still be uncracked and would flex over the crack, allowing the crack to go undetected. I believe that these worries came about because certain manufacturers of high wing two seat kitplanes have been (crudely) MIG welding (instead of TIG or oxy/acetylene welding), and not normalizing the welds afterwards, inviting cracks to occur. The fuselages are powder coated and then crack when put in service. The crack goes undetected until failure and it is the powder coating's fault. First, where is the problem? It is in the manufacturing process and failure to adhere to basic, long established rules of aircraft construction. Nothing will be more superior to powder coating for corrosion protection because of its ability to adhere to and seal the surface of the part.

One of my best buddies regularly flies a Pitts Special he built and competes in the Advanced category. He also does airshows and has a ground level waiver. His preflight includes inspection of the flying wire "pulls" or tabs on the fuselage where the flying wires attach. His fuselage is white powder coated. One day last fall he looked at a wire pull just aft of the firewall on the starboard side and there it was, a crack, clear as day. The metal parted, as did the powder coating, and left a highly visible dark, contrasting line in the paint denoting the crack in the metal below. He swears now that powder coating is the way to go for corrosion protection and that this powder coating hiding the cracks stuff is a bunch of hooey.

There is only one thing better than having a powder coating rig and that is a friend with one!!