Building Blocks
A “Back to basics” project

the Anvil’s Ring/Summer 1988

by Dorothy Stiegler

(Second of two parts)

Here we are again. Let’s finish the project we began in the last issue. Using 18 gauge non-galvanized sheet steel, cut three discs, one in each of the following sizes: 1 1/2”, 3 1/2” and 4” in diameter. Mark both the smallest and the medium discs into quarters, and the largest disc into sixths. Also mark the center point of each disc.

Use cutting shears to cut away the corners between each quarter section on the small and medium discs (see Fig. A).

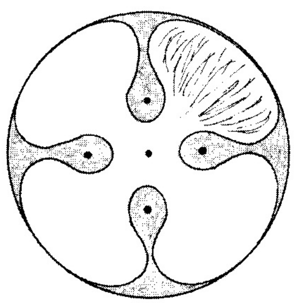


Fig.B

Drill a 3/8” hole between each quarter, 5/8’ from the center mark (see Fig. B). Use the shears to cut down to these holes as shown (also Fig. B). Be careful

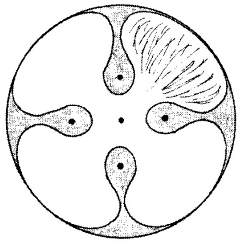


Fig.B

not to cut past the holes.

On the largest discs, mark and cut out six sections as shown in fig. C. Use the shears to cut down between each section to within 1/2” from the center. You don’t want the cuts to meet in the center. File all

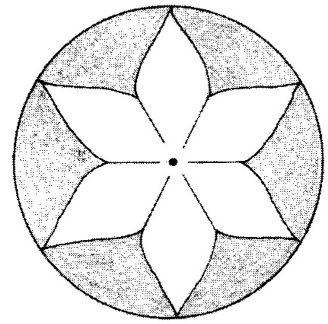


Fig. C

edges.

Now heat each piece and, using a heavy cross peen, hammer-texture the surface in line with the radius of each section or petal (see Fig. B). Take care not to hammer across the petals. Be sure to come clear out to the edge of the petal and keep turning the work in a circle with the left hand as you hammer up and down in place with the right hand. This texturing gives a lacy effect to the flower. You can do this part cold, but if you heat to around 1 2000 (that’s a “red” heat), the lacy effect will be intensified.

Now, "mike” the tenon on the stem you made earlier (preceding article) and drill out the center of all discs (about 1/16’ under the tenon size). With a square file, file the hole until it will slide down over the square tenon. You want a nice snug fit to prevent the blossom from rattling on the stem later. “Super glue” can become your best friend later if you don’t take time for a good fit here.

Now, to help persuade the petals to go in the direction you want them to, you will need to “start” them before assembly. I use a series of rounded ball punches backed by hard wood. The ball punches range from 1/4” to 2’ and use the three most suited to the project — in this case probably a 1/2” ball would do the next step well. Lay the pieces down on the hard wood so the

veining on the smallest disc will be down, and on other two it will be up. At the base of each petal (see the X’s in Fig. A), use a hammer and a ball punch to “set” a dimple in each petal in the direction you want the petal to bend.

Next, measure to be sure your tenon is 3/8" long. It must be cut off if it's longer and filed lower into the hip if it's too short.

On this next step, take care to lay down the petal layers in the correct order. The largest one goes on first and the medium size next, followed by the smallest. Remember, the bottom and middle layers should now have their veins facing up, and on the top layer they should be facing down. Place a monkey tool over the work to "set" the shoulders down onto the tenon. If you don't have a monkey tool, take a 5/8" round X 2" long piece of stock and drill a 1/4" center hole in the end. Make the hole 1/2" 5/8" deep. Be sure to round off the facing edges so it doesn't cut into your work. Once it's set, the tenon is ready to

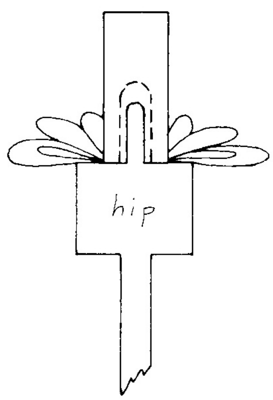


Fig. D

rivet (see Fig. D).

Small tenons should be riveted cold to prevent swelling between the petal layers. use a small ball peen for this. Come straight down onto the tenon head, carefully so it does not bend. Then, using a flat, squaresided punch, "set" the edges of the rivet head down onto the petals all around the border of the head. Make sure everything is nice and tight.

Assemble your oxygen-acetylene torch or propane torch using the smallest tip possible (I use a HenRob Dillon*). I get a pair of wide gooseneck tongs, my needle nose pliers and a can of water ready (for quenching the pliers this is very important). I've found the round neck of the tongs (see Fig. E) is great for a later part of this assembly. (*For more information on this write to: Rob Gunter, 2415 Prince-

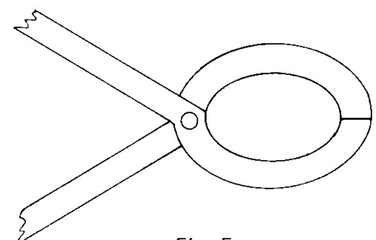


Fig. E

ton N.E., Suite M, Albuquerque, NM, 87107.)

I recommend using sunglasses and/or safety goggles here because heated scale and intense light are hard on your corneas and macula. Look carefully at Fig. F and follow the diagram while rotating the work in a circle. Heat at the X on each one.

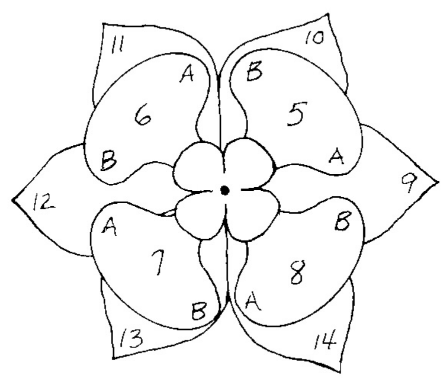


Fig. F

Starting with the top layer, heat area X and use the needle nose pliers to raise each petal straight up from the inner area where the cuts end. Next, gripping the edge of one side of petal #1, curl the edge toward the center. Keep the top outer edge straight so the whole petal will be formed as shown in Fig. G.

Now repeat the process on petal #2 so it will fit into petal #1 (as shown in Fig. H).

top view

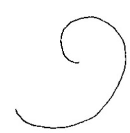


Fig. G


Fig. H

Next do petals #3 and 4 (as shown in Fig. J). I don't close this up tight because I may want to get in there and reset that rivet head later if it rattles I personally can't stand super glue.

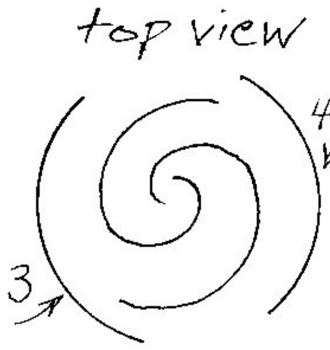


Fig. J

The next layer of petals will become a daffodil cone. (If you prefer a jonquil, make the medium size disc 2 1/2" in the beginning. Everything else remains the same.)

As you heat the base of petal #5 (Fig. F) down close to the rivet, grasp the outside edge with the needle nose pliers and pull the petal straight up, then angle it out at about 75°. Now heat along side "A" of the petal from the tenon to the outside edge, and shape it into a semicircle (as shown in Fig. K.)

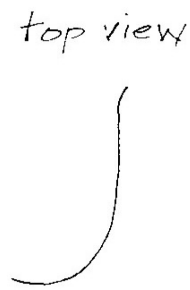


Fig. K

Leave area 5-B of the petal straight, but let the center area of the petal go curvy. Do petals #6, 7 and 8 the same way. All the sides marked "A" go inside the circle. This will now allow you to start with 5-B and curl it into a real half circle, putting 5-B onto the outside of 6-A. Then 6B goes outside 7-A and 7-B goes

outside 8-A, and 8-A goes outside 5A. This makes an overlapping "pinwheel" of the petals.

This is where I use the round neck of those tongs. If I heat that cluster of petals and gently squeeze it within the round neck of my gooseneck tongs, can really get a nice round daffodil center — smaller at the bottom and wider at the top, because everything is at a 75° angle.

Now, heat the top edge of each petal approximately 3/8" from the edge and fold it out at 90° to itself. With a little dexterity you can do this perfectly. (Try to keep the image of a daffodil in your head.) With the veining "in" on the piece, it becomes "out" on the lip, and will become really lacy and pretty.

On petals 9 - 14 (Fig. F), the idea is to dish the center and curl the edges up with the tips also going out. This is easy with the torch and needlenose pliers.

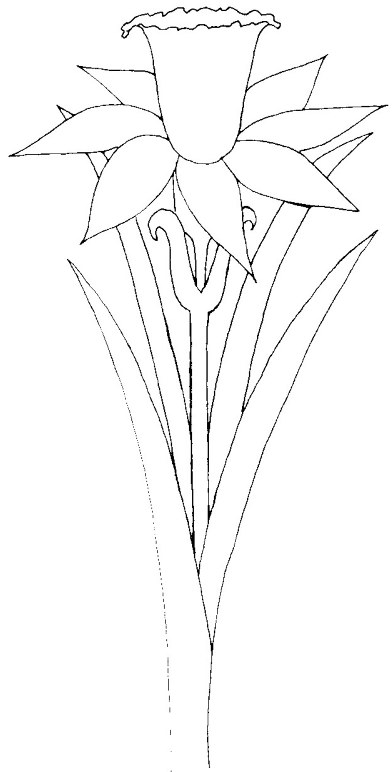
Fine tune the flower now and reset the rivet if necessary. If you do reset, be sure to close the center up. If everything is still nice and tight, then just close up the petals on the top layer, and you're ready to go on to the next step.

Once the flower part is finished, it's time for the leaves. Depending upon the length of the stem, you will need two, four or six leaves. The smallest set goes up under the flower petals. The next set sticks up over the top of the lowest layer of petals, and the third set reaches the height of the first set of leaves.

If you wish to gas weld these leaves on, it's smooth sailing from here. Simply crimp those ends around the stem and weld up. Start with the pair of leaves that will be closest to the flower. Daffodils have paired leaves. Be sure to file.

For the forge welders among us, there is a real slick way to do this job. Start with the set of leaves that will be closest to the flower and get the leaf stems curved enough so the stem will fit nicely. Then lay a piece of 2" thick 4" X 5" stock on the forge for use as an anvil. Next assemble two tongs, a rounding hammer, and anhydrous borax. After putting borax in the stem troughs of the leaves, lay both leaves (the first set of two) on the left side of the forge near the fire. I hammer right-handed, so I place my favorite hand hammer on my right.

Use two pair of tongs, one to hold a leaf in the



left hand, one to hold the stem (with flower out towards you). Bring the stem of the flower up to approximately 2200° and move the leaf into the fire with the left hand, while fluxing the stem and holding it with the right hand.

Flux quickly so as to lose no heat, then put the stem back into the fire and raise it to approximately 2400°, holding the leaf at the edge of the fire. As the stem heats to 2500°, move the leaf into the forge weld heat. In this way it will rise quickly to the necessary temperature. Pull the leaf out with the left hand and the flower stem with your right. Giving them a quick fling, lay the stem down on the makeshift anvil on the forge. Place the leaf on top of this anvil (with your left hand), drop the tongs in your right hand (your left hand will be holding the work down) and pick up the hammer to tack the pieces together.

All of us "6-week Turley wonders" have seen the drop-tong trick. Repeat the process with the second leaf placing it opposite the first one. Then take a welding heat over all and finish it up. Add as many pairs of leaves as you wish. You may want to take a dry run or two to get the movements down before you work on your completed piece.

For the finish I use a nice red heat over all. Stick the work in your gas or coal forge, or heat throughout with the rosebud on your oxygen-acetylene or propane torch. Then, as the temperature falls below 800° (it does this while you turn everything off and fix it in the vice), brush with a soft brass brush. it gives a terrific brass plating finish to the edges of the petals. Don't get too heavy handed with this or it can end up looking tacky. Next apply beeswax to cover the entire piece. As it cools blow it off with an air hose to keep it from forming "drip lines".

A product called "Treasure Gold" is amazing for edge highlighting. Put some on your index finger and run it along the leading edge of the work on all surfaces. You can use a Q-Tip for this operation when reaching inside areas. Again, be careful not to get too heavy with this finish or it will look tacky.

For a base you can drill a hole into a piece of marble to hold the flower stem. Add some super-glue into the hole to help hold the stem. You will have a beautiful daffodil sculpture. See you next time!

This article was reprinted courtesy of the author Dorothy Stiegler, The Anvil's Ring and ABANA. It was originally published in the Summer Issue of the Anvil's Ring 1988, Volume 16 Issue 1. Reprinting of this article must be cleared through the ABANA publishing committee

Forging Notes for Non-ferrous Metals:

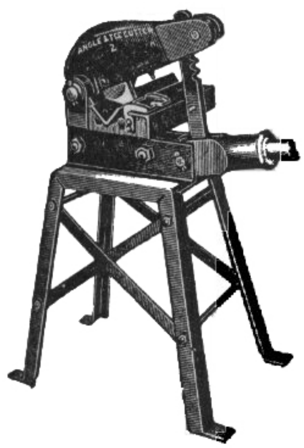
by Brian F. Russell,
Forging On The River VIII
From the River Bluff Forge Council,
Memphis Tennessee

Non ferrous metals are defined as those which have little or no iron in their composition. They include aluminum, brasses, bronzes, as well as the precious metals such as platinum, gold and silver. The non-ferrous metals are generally used in alloy form, being alloyed with elements common to the steels, such as nickel, manganese and silicon. Alloying two different non-ferrous metals to create a third is frequently done as well.

Due to their higher conductivity heating in a gas forge rather than a coal forge provides a greater degree of control over the result. A medium heat rather than a welding heat provides more control as well.

Aluminum

The most commonly available alloy of aluminum is designated 6061-T6. The suffix refers to the level of initial heat treat, with T6 designating solution heat treating and artificial aging. This alloy is referred to as a wrought alloy and has a nominal composition of: .6 Si, .28 Cu, 1.0 Mg, .20 Cr., remainder Aluminum and impurities, always including trace amounts of iron. This alloy is heat treatable.



Forging 6061 -T6 requires considerable attention to the temperature. Forging begins at 750 F and ends at 950 F. As this is below the incandescent range and aluminum doesn't oxide in the same way as steel with temper colors, there is no color indicator during heating. Thus there are a number of methods to determine when the material is ready for forging. A pine stick, such as a paint stirrer or door shim when dragged across the surface of 750F aluminum will leave a black scorch mark. A mark made on the aluminum with a black felt tip pen prior to heating will turn brown in the forge upon reaching approximately 750F. This method seems to have more variability than the pine stick method. Thirdly, there are commercially available "tempilsticks" with highly refined temperature ranges. The pine stick method yields the best results because it requires active diligence in monitoring the temperature. It is very easy to overheat the material, and it is immediately obvious upon beginning to hammer as the material crumbles under the first blow!

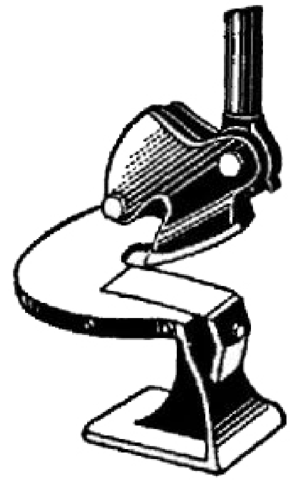
Aluminum, because of its unique structure, retains and conducts heat readily. As well, it has a low melting temperature (1220°F). This feature can cause overheating of the work as forging with power progresses. Thin sections can overheat, causing cracking and crumbling. Restraint should be used when working thin sections to ensure that the aluminum stays within the forging range. Gentle heating yields good results when doing scroll work, as aluminum can tend to bend unevenly if not allowed to come to temperature slowly. Again, patience and diligence will yield the best results.

Welding aluminum is best achieved with the shielded metal arc process (MIG or TIG). Clean the surfaces by abrasion or wire brushing immediately prior to welding. This is extremely important when welding aluminum. Designate a stainless wire brush specifically for this task. Use 100% argon shielding gas. AC TIG welding is generally preferred for manual welding of material up to 1/2' in thickness. Use a pure tungsten electrode. For DC TIG use a 2% thoriated tungsten electrode. For thick sections .MIG welding provides much faster welding with deeper penetration. A spool gun makes it easier, although a short cablehose kept relatively straight (to prevent kinking the soft wire) also works adequately. Refer to a welding manual (see references) for complete information on welding practices. Grinding aluminum is best done with zirconia (blue)discs or specially designated hard discs that reduce loading. Also, belt grease/ lubricant in conjunction with reduced pressure prevents loading on the abrasives. For die grinding there is a line of special coarser burrs that don't load as much as double cut burrs. Sandblasting and wirebrushing finished works gives an attractive satin finish. The use of solvent dies in acrylic lacquer is another interesting way of finishing. Polished / brushed aluminum should be top coated with a clear acrylic lacquer to prevent surface oxidation.

Bronze

Two types of bronze useful for forging are silicon bronze and aluminum bronze. . Aluminum bronze C954 has a composition of 85 Cu, 4 Fe, 11 Al. It is technically speaking not a true bronze as it contains no tin but is referred to as a binary alloy. Stock for forging is available as continuous cast and hot rolled squares and flats, sold oversize. This material is rather rough looking and the surface has a pattern of very small fissures that disappear upon forging or which can be removed by rough grinding. It is recommended that stock be purchased oversize and forged under power to the desired nominal size. Alloy 614 is the sheet form of Al. Bronze: 91 Cu 7 Al. Its slightly different composition means that there may be a slight color variation between 954 and 614.

Forge aluminum bronze in the red to yellow orange range. It is very forgiving and overheated stock can be allowed to cool without it disrupting. Unlike most other copper based alloys, aluminum bronze is extremely stiff when cold and straightening pieces when cold is problematic. When worked in the temperature range the metal shows very little tendency to edge cracking when drawn out thin and during hot bending. It scrolls very smoothly. Weld aluminum

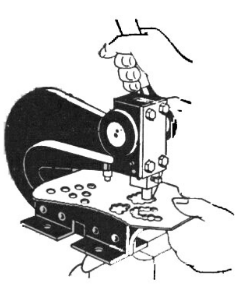


bronze with A MIG, using Ampcotrode 10 wire (.035) and 100% argon. Higher wire speeds (amperage) and lower voltage than used in welding steel is generally the case. Preheating is usually not necessary except for very thick sections (1.5' +). The wire is very stiff and can be run in a regular cable hose up to 15'. Joints should be vee'd wider than steel, to around 55-60 degrees. Thinner sections can also be TIG welded using 2% thoriated tungsten electrodes, DCEP and 100% argon. Grinding can be accomplished with the same materials as used for steel. Aluminum bronze is hard enough that loading of abrasives is not a problem. Drilling and tapping requires sharp tools. A dull drill bit will not work on aluminum bronze. Cutting this hard material on a bandsaw requires a higher blade speed (270 fpm) and more. Aluminum bronze accepts patinas, although testing is a must. The polished material has a beautiful golden hue, more yellow than silicon bronze. Flame oxidizing is another useful finishing method.

Silicon bronze, c655. is available in cold rolled forms as bar stock and sheetplate. It has a reddish hue due to the very high copper content (97 Cu, 3 Si). Working temperature range for forging is slightly lower than for aluminum bronze, generally red to bright orange. It will fall apart at too high temperatures. It exhibits excellent forging characteristics, with little cracking in thin sections and bends. Because it is available in plate as well as bar it is an ideal choice for the construction of sculptural forms. Cold bending / straightening is more forgiving than aluminum bronze, but care must be used to prevent cold cracking. Welding is similar to aluminum bronze and an exact matching MIG wire is available. It will work in a standard cablehose. TIG welding (DCEP) with a 2% thoriated electrode is an excellent choice for sheet and plate up to 1/4". Welds flow beautifully. Vee thick joints to 45 degrees. Because of its softer nature silicon bronze grinds easily and quickly with standard abrasives and burrs without loading. It accepts patinas more easily than aluminum bronze, although it has more tendency to change as it ages due to oxidation, Therefore a clear acrylic lacquer topcoat is recommended.

Copper

Pure copper is a joy to forge. It has a very long working range, essentially from cold to yellow. Because of its malleability it is rare for copper to crack during forging or bending. When worked hot there is no need to anneal because there is no work hardening occurring. And when finish working thicker sections cold there is usually no need to anneal. For sheet, anneal by heating through to red, then quenching in cold water. For thin sections cold planishing to work harden effectively adds stiffness and strength. Because of its softness careful planning of the work sequence is necessary to prevent deformation of previously worked areas. Even when cold it is possible to easily bend 1" x1" sections, especially when working in the vise. Copper can of course be soldered or brazed, but these methods lack the strength necessary for joining larger sculptural shapes. Copper can be MIG welded using pure copper wire with a special gas mix tradenamed Blue Shield #5. Preheating is absolutely essential as the copper conducts the heat so quickly and has a high melting temperature (1980° F). For tapping threads into copper a thread forming tap rather than cutting tap works better. Copper can be quite "gummy" due to its softness when machining. When sawing use higher blade speeds (270 fpm) with a coarse blade. Copper is very reactive and receives patinas wonderfully, both hot and cold.



Safety

Welding and grinding non-ferrous metals produce unique pollutants that may have deleterious effects on your body's health. The use of common sense, ventilation and the appropriate safety gear including respirators and safety glasses is essential.

Contact

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email: info@powerhammers.com www.brianrusselldesigns.com www.powerhammers.com

References

Metallurgy Fundamentals by Daniel A. Brandt ISBN 0-87006-922-5
Welding Aluminum: Theory and Practice The Aluminum Association ISBN 89-080539
Metals for Engineering Craftsmen, COSIRA
Machinery Handbook 25th Edition

Sources of Supply

Aluminum bronze:
Sequoia Brass and Copper 2289 Industrial Pkwy. West Hayward, CA 94545 800-362-5255. Will drop ship from many locations around the country.

Mig wire for aluminum bronze
Repair Alloy 414-542-9747 Ampcotrode 10 in 2 lb and 30 lb spools. Silicon Bronze
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Reprinted from the Guild of Metalsmiths June 2002

Just a Tip:

by David Mariette
Guild of Metalsmiths Volume 26 No.2 June 2002

In the last issue I started a column to pass on tips and tid-bits of information that I thought may be helpful in your endeavors at the forge.

Recently, there was a question posed to "The Bellows," an on-line question/answer board that is run through The Guild of Metalsmiths, that had to do with smoke in the shop. chimneys, ventilation, and etc. There were many very good responses to this question. One response in particular by Pete Stanaitis started me thinking beyond the question of ventilation, and on to a different subject, but of a related nature.

Pete had noted that a strategically placed shovel of coal on your fire, especially at fire-up, could help direct the smoke to the chimney instead of into the room. (Forgive me Pete. That is not a direct quote from "The Bellows," but I did not save the text. I hope I got the general idea anyway.) Once again I was reminded how important good fire management is to successful forgework. I have observed, as a teacher, that students that "work their fires" as they do their iron, are usually most successful.

An unattended fire, and by unattended I mean a fire that just gets used and used with little or no maintenance, can cause many complications if not flat out danger. When I was at the Ozark School, one student that I remember kept forging, adding coal, forging, and adding coal. He had such a big fire that the radiant heat from the forge literally started the wall of the school on fire.

When teaching forge welding classes I begin to expose the students to forging at much higher temperature. It is understandable that a person could think, "well, more heat means bigger fire." I have had my own students that have had their fires so big I could not stand in front of the fire, because it was too big and gave off too much heat. I can also say proudly that I have built a few pyres myself over the years, and they have been dandies. In trying to find a better way I have made a few observations and have one real good tip for controlling your fire so that you get the heat you need and keep the size of your fire manageable. You will be much more comfortable forging, use less coal, and do a better job

First of all, the coal. When you fire up the coal you will notice that as it burns and begins its cokeing process. It will form a crust over the top of your fire. This characteristic of the coal to meld together is referred to as plasticity. As this little plastic dome forms over your fire you have to push more air through the fire to get heat, because as this crust seals off the top of your fire, it impedes air from freely flowing through the fire.

As you are now pushing more air through the fire, the fire is now venting itself around the outside of the crust forcing smoke and hot gases to take an indirect path out of the fire. As this happens you are actually spreading your fire laterally underneath the crust. In further efforts to shoot yourself in the foot, you now have such a big fire brewing under that sucker, it takes even more air to get that baby up to temperature and pretty soon, wolla, you are out of control.

Then you start pouring water on the fire to try to make it smaller so you can actually stand in front of it. As the fire cools you again start pushing more air through the fire. Now, some of that water you have just put on the fire finds it way to the center of the fire causing a separation of hydrogen and oxygen sending a fireball out through the bottom of the fire-pot, out the air duct, an finally out the intake ports of your fan, scaring the hell out of the person forging next to you if not singeing their butt in the process. Nothing good happens with a fire of this nature. Sound familiar?

As you fire up, and as that crust begins to form on top of your fire use your fire rake to poke a hole in the top of your fire to act as a chimney. This simple task will allow the smoke and hot gasses to vent directly up and out of your fire keeping that hot spot of your fire directly over the twyere where you want it. It also will take less air to drive your fire. If you are using a crank blower this means less effort running the blower. It will cause less smoke to go astray in your shop because it will enhance the performance of whatever venting system you have. It will keep your fire from spreading and getting out of control.

See you at the forge!

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Membership is from
Jan. 1 — Dec. 31

PENNSYLVANIA Artist BLACKSMITHS' ASSOCIATION

New Jersey
Blacksmiths Association
90 William Avenue
Staten Island, New York 10308
Attn: Larry Brown, Editor

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How to Join or Renew your Membership in NJBA:

NJBA Dues are $18 per year (as of July 1, 2001).
Please make your check out to: "NJBA"
<u>Please mail checks to:</u>
NJBA, P.O. Box 195, Howell, N.J. 07731

Please include payment with the information listed below. You will receive a postcard confirmation of your membership, and will receive a newsletter within a month. NJBA's "year" runs from June to June. If you join mid-year, the postcard will offer a prorated dues option which will then allow you to extend your membership till the following June. The following information will be listed in a roster available to other members.

Name ______________________ Home Phone_________________
Address ___________________ Day Phone _________________
City ____
State _______________________ Zip ________________________
E-Mail _____________________ Skill Level (optional)___________
Comments ____