

Build a foundry and sand-cast aluminum.

by **Fenris The bbw** on April 18, 2009

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Intro: Build a foundry and sand-cast aluminum.

Hello instructableers, DIYers, and Internet people everywhere! Welcome to my debut instructable!!!!

(*Whooo, We love you Fenris! You rock! Give me your socks for my creepily obsessive collection of things related to you!*).

Thank you, thank you! But really, I must get to the instructable, settle down please.

In this instructable, I will detail how to construct a simple, cheap, and effective foundry, capable of melting aluminum. This foundry can be built quickly, with little tools or money, and is great for beginning metal-casters.

I'm entering this in the Epilog laser cutter challenge, so if you like it (as if you couldn't), please vote.

I'll be your best friend ;)



Image Notes

1. Note the awesome

Step 1: How this is green

Before I instructify your minds, let me tell you how this project is green.

I live in Hattiesburg, Mississippi, and in Hattiesburg there is no recycling center. The nearest center is in Jackson, Mississippi; which is about 80 miles away. Nobody wants to drive 2 hours just to turn in some cans they could have thrown away in 5 seconds.

That's where me and my friends come in.

Our friends, family, and even random people who just want to recycle bring us pounds of aluminum cans each week, which ordinarily would just be taking up space in a landfill.

We melt down their trash to create tools or art, which we then can either sell or give away.

And though this foundry design pollutes the air with smoke and fumes, it teaches us (and any other beginning metal-caster who wishes to learn with us) what we need to know to build greener, more efficient designs which run off of clean-burning propane or use waste-oil as the fuel (reducing the amount of toxic chemicals people would be dumping elsewhere).

As we learn how to build cleaner, more efficient foundries, I will post instructables, so people in places like Hattiesburg, MS, will be able to do their part to save our planet.

On to the legalities!



Step 2: Legal and precautionary statements.

First off, this instructable deals with fire, molten metal, sharp edges, electrical equipment near water, burning paint/other noxious fumes, and probably some other dangers I don't even know about. If you are a clutzy, hyper, or unattentive person you really shouldn't try doing this.

By reading this instructable you agree that I am not liable for any of the numerous injuries you may incur, property damaged, people harmed, or anything else you could think to sue me over, while building and operating the foundry described within said instructable

That being said, If you follow my instructions you should have no problems with safety. I will do my best to detail the safest way to do this.

Step 3: Read up. Arm yourself with knowledge

Casting metals can be complicated. It's a good idea to get a feel for it first.

Metal-casting Instructables.

<http://www.instructables.com/id/Waste-Oil-Furnace-For-Melting-Metal/>
<http://www.instructables.com/id/Building-a-furnace-creating-molds-and-casting-je/>
http://www.instructables.com/id/Quick_cheap_and_dirty_aluminum_melting_furnace_s/
<http://www.instructables.com/id/Coffe-Can-Aluminum-Foundry/>
<http://www.instructables.com/id/Waste-Oil-Forge-and-Foundry/>
<http://www.instructables.com/id/Pizza-Sauce-Can-Furnace/>
http://www.instructables.com/id/Aluminum_Foundry/

Some good examples of what we're doing.

<http://www.visi.com/~darus/foundry/>
<http://www.gizmology.net/furnace.htm>

A list of even **MORE** links.

<http://www.abymc.com/Links.html>

Step 4: Materials and tools.

I built my furnace for nothing, and you can too if you borrow some tools and swipe some trash.

Required to build furnace

Tools

- Drill with large bit suitable for steel. (Hammer and large steel spike can be substituted)
- Tin snips

Parts

- 2 coffee cans of equal dimensions (one for furnace, one for air chamber)
- 1 hair dryer with a cold air setting
- 1 tin can (Blue Runner bean cans are the perfect size and are very sturdy)
- At least 4 metal stakes (optional)

Required to operate furnace

Stuff

- Instant light charcoal
- Charcoal lighter fluid
- Barbeque lighter (the long-nozzled kind)

<http://www.instructables.com/id/Build-a-foundry-and-sand-cast-aluminum/>

- A bucket of water (to cool hot tools)
- Aluminum cans
- 3 or more boxes (optional)

Tools

- Tongs (I use 2 pairs)
- Some sort of long, metal stick

Safety gear

- Leather gloves (preferably welding)
- 100% Leather and/or cotton upper torso/arm coverings (Big Smith jackets are perfect)
- Gas mask (optional, you can just hold your breath when near the furnace)

Required to make mold

- a large container
- sand
- Something to impint a design in sand with or way to draw in sand (pottery, carvings, body parts

etc.)



Step 5: Building the air chamber

Use your tin snips to cut a hole in one of the coffee cans for the hairdryer to fit into. It's O.K. if there are some corners that don't quite conform to the hair-dryers nozzle, mine don't and my foundry works just fine (See pic 2)



Step 6: Building the fire chamber

Using your drill (or hammer/spike combo) make holes in the bottom of the other coffee can. Again uniformity is not a requirement.



Step 7: Assembling the furnace

There is a simple way to do this-

1. Insert hair-dryer into air chamber
2. Put fire chamber on top of air chamber

-Which is easy as pie but extremely dangerous. If the fire chamber is nudged even the slightest bit the whole thing will topple over, creating a gauntlet of hot coals and molten metal at your feet.

On the other hand though, being able to remove the fire chamber from the furnace gives you the advantage of being able to shake out the coal dust that will eventually clog the holes to the air chamber. This allows you to keep the fire burning hot longer for multiple melts.

If you feel you can't handle having the fire chamber loose, than you should dig a fire pit, fill it with sand, and put metal stakes in the ground running along the sides of the cans. This will hold the cans in place but still allow you to quickly remove the fire chamber.



Step 8: Destroying your aluminum cans.

It is important to separate the parts of the can, as they all produce different amounts of dross (trash in the metal which has to be removed), and should be melted at different points in each smelting.

The 3 sections which have to be separated are the top, the sides, and the bottom of the can.

My favorite method for destroying the cans is illustrated in the pictures. Unfortunately, I can't get the image notes to work, so you'll have to read the procedure up here and follow along with the pictures below.

1. Cut or rip the can in half.
2. Make a slit in the top half, perpendicular to the lid.
3. Tear along the slit and pull the siding off of the can top.
4. Make a slit in the bottom half of the can, at an angle to the bottom.
5. Tear as close to the bottom as you can, and remove siding.

This goes much faster if you form a production line with some friends in which one person has one of the steps above assigned to him/her.

I sort the cans into boxes of halves, siding, tops, and bottoms, with the occasional box for cans with painted tops or bottoms.

Once you're done with your cans, it's time to ready your foundry.





Step 9: Laying the coal.

With the furnace assembled, place a ring of coals around the bottom of the fire chamber (pic 1), Then place two coals perpendicular to the ground in the center of the ring, leaning against each other (pics 2+3). This increases airflow under the can, which helps to heat all the coals and ultimately provides a better melt. The wrong way to do this would be to put one coal flat under the can, (pic 4) blocking airflow from the center of the furnace.

Next put the tin (steel actually) can on top of the two central coals and add coals evenly to the sides of the tin until it stands on it's own.



Step 10: Making the mold

If you don't want to make a mold, just some metal blobs (ingots), you can pour the molten aluminum into a muffin tin. The ingots can be re-melted later if you need the metal.

Making a sand mold is easy. All you need is some sand and a way to imprint a design in it.

You could do this with a stick or something, but it probably wouldn't turn out well. I find you get the best results when you use something with a 3-D pattern on it. In this instance I used some pottery, I found at the flea market.

If you have a friend (or friends) working with you, they could make a cool design, while you melt the metal.

Now all that's left to do is prepare your work-space.





Step 11: Foundry Feng-shui.

There are a million possible misfortunes waiting in a foundry, and you can eliminate almost all of them by being prepared.

I have here some pictures of my foundry set-up and running, as well as some pictures of me operating it.

Notice that the cords are held away from the walkspace with a bucket so I won't trip on them, and that the water and aluminum (i.e. conductive materials) are on the other side of the walkspace.

You need to be able to walk in a complete circle around the furnace without bumping into anything.

The water and mold need to be where you can reach them quickly when you need them, but not so close to you that you bump them.

If you've done all of the above, it's finally time to start up your furnace!





Step 12: Starting the furnace. (FINALLY!)

Make sure all your safety gear is in place and then get ready to finally do some metal-melting!

First load your crucible half-way full of can tops, they burn the cleanest, so burning them first yields more molten aluminum to submerge other can parts in.

Then, light the charcoal!!!! Whooooo! fire!

If you use regular charcoal, you have to use lighter fluid, which can drip through the furnace onto the hairdryer, for this reason I only use coals that light instantly in my furnace.

As soon as you think all the coals under and around the crucible are lit, start the hair-dryer.

Next you need to add coals to the side of the crucible until they form as even a layer as possible around it's center.

Once the can tops start to melt and you can see the can glowing red it's time to move on to the next step.



Step 13: Operating the furnace.

I had several instructional videos to show you, but my mother managed to unintentionally delete them off of her camera.

The world weeps.

It's O.K. though, operating the furnace is pretty straight-forward.
All you really need to do is

- 1.Fill the crucible of aluminum scraps
- 2.Cool the tongs in water
- 3.Let the aluminum melt
- 4.Use a metal pole to remove dross (Gross stuff floating at the surface)
- 5.Cool metal pole in water.
- 6.And repeat

If you don't have a gas-mask then you need to hold your breath when you feel hot air from the furnace hitting your face

Aluminum scraps should be melted in this order; can tops, can bottoms, and then can sides.
This is in order of metal-to-dross yield.

<http://www.instructables.com/id/Build-a-foundry-and-sand-cast-aluminum/>

Dross should be removed quickly after the aluminum melts, or else it will clump together with some of the aluminum and stick to the sides of the can, reducing the amount of pure aluminum you can get per pour. There are some pictures of me removing dross below.

Also you must be careful with hot tools, not only because they can burn you, but because they can burn other things.

For example, If you use hot tongs to try to grab coal out of the coal-bag, the coal could ignite setting the entire bag aflame.

When you notice that the crucible's glow is starting to fade, either add more coal to the fire, or prepare your mold for pouring.



Step 14: Pouring the mold

The most self-explanatory step. Pick up your crucible with your tongs and pour the molten aluminum into your mold.

The aluminum has a smooth look to it's surface while it's still molten, but if you watch closely, you can see it start to crystallize.

Try not to pour from too high or the aluminum will crush the detail out of the mold.

Again, I apologize for the lack of videos, I'll try to upload some soon.

Here's a pic of the finished product. (I didn't use enough aluminum) :(



Step 15: Come on...

...lets be honest with ourselves, you know you loved this instructable, I know you loved this instructable, we both know you loved this instructable. So why are we playing this game? Stop playing coy and vote for this instructable!

Seriously though, the laser cutter would be put to good use.

Related Instructables



Quick and cheap aluminum melting furnace setup by robbtoberfest



My Second Aluminium Foundry by NutandBolt



Coffee Can Aluminium Foundry by 2k4u



Entwined Hearts Cast in Aluminum by spike3579



Foundry Sand Casting Ramming Tool by NutandBolt



Aluminum Foundry by StaticPhocus

Comments

50 comments

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Kurt_ says:

Dec 16, 2010. 8:36 PM [REPLY](#)

Sand Casting actually involves clay to stabilize the sand so it doesn't crumble, and so you can have a two-piece mold like in industrial uses.

Other than that, nice instructable. It's ghetto-tastic, just the way I like it!

Read how to make casting sand here:

http://www.ehow.com/how_6065035_mix-sand-casting-aluminum.html



pidlyb0b1 says:

Oct 27, 2010. 4:03 PM [REPLY](#)

can you hook up a miniature A/C in replacement for the hair dryer.



pidlyb0b1 says:

Oct 18, 2010. 10:20 PM [REPLY](#)

will it work with brass?



general-Insano says:

Oct 27, 2010. 8:58 AM [REPLY](#)

yes it could work with brass but you will have to be very careful in not letting the copper and zinc separate.



Firestorm_101 says:

Sep 29, 2010. 7:32 AM [REPLY](#)

How do you make 3d designs like ring, bracelets, bangles, etc? Could you put a material within the sand with a gap upto, that would incinerate immediately while pouring in the molten liquid?



badideasrus says:

Oct 6, 2010. 9:17 PM [REPLY](#)

..... it wont let me reply to myself..... oh well. the show was called 'animal face-off' i can't find a full video, so i cant find the casting stuff, but i liked it so much i wrote it down as a kid once..... so i'm pretty sure i've got it right. the only thing (besides it being a special sand or not) was weather they used a sprue hole..... which kind of ties in to the sand being special or not, cuz iron sand would melt, making a hole...

but hes, you could use a burnable material.... look up lost wax casting. same thing, basically, just without the sand.

=====note:

sand casting wouldn't work so well with jewelry, though..... unless you have extremely fine sand, your detail level will be degraded, cuz your detail is restricted to the size of the grains of sand. if it's course, it will leave pits and bumps in the surface of your jewelry.



badideasrus says:

Oct 6, 2010. 8:58 PM [REPLY](#)

there was a show were they would see which of two animals would win if they ever got into a fight. i loved the show, not only because of the awesome idea, but because they always made a black iron replica of said animals skull (complete with teeth) or claws or what not ON THE SHOW. they even explained what they were doing.

they would pretty much do sand casting, however they would use foam, like styrofoam, that they carved into shape, and just pour the molten metal onto the sand. i don't think they even made sprue. of course, i think they used iron sand..... may be important....

the downside to this is that the metal was kind of pitted.



neorazz says:

Nov 14, 2010. 6:08 AM [REPLY](#)

i remember that show they would overcast the teeth and then polish them down to size i though them to be unrealistic in comparison to the same size tooth in enamel/bone (much higher psi before breaking) but the metal work idea is sound if your making your own foam molds enlarge them a bit then you can machine off the excess for a good finish where you need it



badideasrus says:

Dec 5, 2010. 10:09 AM [REPLY](#)

hmm.... good point. i didn't remember that. i agree about the breaking thing though. very hard to gain real evidence without using real props.... still, you can't say you wouldn't love haveing a solid steel tiger skull on your dresser.



182515 says:

Jun 11, 2010. 5:54 PM [REPLY](#)

do you think that this would be hot enough to melt copper scrap? (old piping brass pipe clamps)



wow-amazing says:

Jul 13, 2010. 4:42 AM [REPLY](#)

With enough airflow, probably yes. You probably want to check into the melting temperature of copper or whatever else you want to melt, and make sure it isn't too close to the weakening temperature of your crucible. Of course, you could always just make a ceramic (fired clay) crucible. I don't believe ceramics could be melted by burning coals.



sypher12616 says:

May 14, 2010. 5:52 PM [REPLY](#)

bad bad bad, be really careful if you decide to do this, aluminum will literally explode if it comes into contact with water if you use sand the chances of hurting yourself are very high. professionals use special casting sand that has a low water content mixed with oil called petrobond



cd41 says:

Apr 29, 2009. 8:14 PM [REPLY](#)

You could use the laser cutter to cut a better setup(i am not sure if they cut what your using.



chirman23 says:

Feb 22, 2010. 11:55 AM [REPLY](#)

Its called a plasma cutter and there very expensive so its not a very good remedy.



sreenvas says:

Feb 7, 2010. 3:33 PM [REPLY](#)

is there any catalyst that can speed up melting and reduce the melting point?
sreenvas@yahoo.com




--= Excogitate --= says:

Jan 16, 2010. 8:52 PM [REPLY](#)

Here's a beefed up version inspired by this instructable! I'll load some pictures of it in action once the perlite/quikrete insulation cures.





 **greenjedi** says: Dec 26, 2009. 5:42 PM [REPLY](#)
Could you use a coffee mug as a ceramic crucible?


 **Fenris The bbw** says: Jan 5, 2010. 11:18 PM [REPLY](#)
As far as I know, no. You could try it though. I tried it once and it broke, though I couldn't tell if it was from the heat or from me bumping the foundry.
Probably both.


 **man ray** says: Jun 10, 2009. 1:46 PM [REPLY](#)
what did you use for a crucible?


 **Fenris The bbw** says: Jun 22, 2009. 12:14 PM [REPLY](#)
A tin can.


 **Wyle_E** says: Aug 4, 2009. 9:43 PM [REPLY](#)
That was certainly a steel can. BTW, I've seen a lot of aluminum soup cans lately. They usually have pull-tab tops. Before you use a food can for a crucible, check it with a magnet. The best cheap crucible for aluminum and zinc alloys is a short piece of steel pipe with a piece of steel plate welded over one end. I haven't checked with local welding shops, but it would probably cost less than the cheapest clay-graphite crucible from Budget Casting Supply. There are a *lot* of web sites devoted to amateur foundry. www.backyardmetalcasting.com is a good start.


 **Fenris The bbw** says: Aug 6, 2009. 2:05 PM [REPLY](#)
I think i adress that most cans are made out of steel somewhere, but for the life of me, i can't figure out where. Probably in the comments somewhere. Also, a welded crucible would probably work better, but I'm trying to make this build as simple as possible so others with no experience can replicate it.


 **legendeveryone** says: Dec 10, 2009. 1:47 PM [REPLY](#)
Can you use a glass bottle or container as a crucible? I know it has a much higher melting point than aluminum and is somewhat easier to come by than steel.

 **Fenris The bbw** says: Dec 11, 2009. 7:18 PM [REPLY](#)
The short answer, no.
The long answer no becuz it'll explode, or at least crack, which would waste all the aluminum.

 **backyardmunitionist** says: Oct 1, 2009. 2:50 AM [REPLY](#)
Have you ever tried a ceramic crucible? I was wondering if you would get a purer product if you didn't have the ferric metal possibly alloying minutely with the aluminum.

 **Fenris The bbw** says: Dec 11, 2009. 7:17 PM [REPLY](#)
A ceramic crucible would be awesome. But I'm trying to keep it cheap and only use garbage for my materials.
Also, I don't think the steel alloys with the aluminum at all, but rust flakes might get in the melt if you use the same crucible more than once.

 **leifbus** says: May 18, 2010. 11:54 AM [REPLY](#)
Could you make a crucible out of plaster? (since you could cast the aluminum into it anyway?)

 **Wyle_E** says: May 26, 2010. 8:12 AM [REPLY](#)
Plaster, like portland cement, sets by a hydration reaction. Get it hot enough and it dehydrates, turning back into dust. The furnace is going to be a lot hotter than a mold full of molten metal.



alexd619 says:

Kudos!!! i just had some fun melting an aluminum chair lol

Nov 20, 2009. 6:52 PM [REPLY](#)



unseen wombat says:

On the almost-identical furnace I built years ago, I screwed three small steel tabs to the outside of the wall of the plenum such that they stuck up above the top. Then the upper can just slid right down inside them. No chance to topple and perfect alignment every time.

The tabs were about 1/2" wide by 2" long and 1/16" thick and available at home depot or lowes. I attached them with two screws each so they couldn't pivot.

Also, doesn't your hair dryer melt? I had an old dryer from the 60's with a hose attachment which I hooked up to the plenum with some pvc fittings. The PVC melted the first firing. Then I got some brass fittings and it was fine.

Oct 9, 2009. 1:00 PM [REPLY](#)



Fenris The bbw says:

I do something similar to the steel tabs with stakes driven into the ground along the edge of the cans. Not as pretty, but it holds them in place.

And I've been wondering about the dryer myself. It's got scorch marks all over the nozzle, but it seems to not be melting at all.

Oct 9, 2009. 8:02 PM [REPLY](#)



I died with my head in a washing machine says:

FIRE,SHARP METAL,DANGER its as good as made!!!!!!! :) :)

Oct 6, 2009. 11:11 AM [REPLY](#)



Roger4Wheel says:

I would put 3 small peices of clay brick (the same height) under the can instead of charcoal.

Oct 2, 2009. 10:57 AM [REPLY](#)



manicmonday says:

Seems like I've heard somewhere on TV or something that you can use talc to prevent oxydation. Anyone know anything about that?

Sep 29, 2009. 9:32 AM [REPLY](#)



junits15 says:

put a rol of pennys in, they if its hot enough, they will burn blue.

Sep 24, 2009. 6:12 PM [REPLY](#)



Kaiouss says:

I noticed that it looks like you didn't use any refractory on this project; does that shorten the life of this foundry? Also, I'm looking to make some casts of what is essentially a doll, so do you know of a good substance for making the cast? I'm guessing plaster won't work on this one :-)

Sep 10, 2009. 9:58 AM [REPLY](#)



trf says:

Not using refractory does shorten life. Ive made charcoal foundrys before and the steel eventually does give way but after a while. depending on what ur melting u may need refractory...using a steel furnace to melt steel doesnt work well =P

Sep 17, 2009. 8:43 PM [REPLY](#)



Fenris The bbw says:

It doesn't shorten the foundries life, mine still works perfectly fine, but it does sap some of the efficiency from it.

If you want to use refractory, check out this link.

<http://www.backyardmetalcasting.com/refractories.html>

Just keep in mind you'll need a bigger container than the coffee-can if you do.

I'd reccomend using greensand for the mold, but I'm biased since that's all I've ever used.

<http://www.backyardmetalcasting.com/greensand.html>

Sep 12, 2009. 1:16 PM [REPLY](#)



Kaiouss says:

Excellent, I'll check those out. Unfortunately, I live in an apartment, so finding space will be issue number one for me. Thanks for the tips and the great instructable!

Sep 13, 2009. 4:21 AM [REPLY](#)



cryophile says:

Does it matter how many holes you poke in the can? I think I have more than thirty. I'm worried about the can falling apart.

Aug 18, 2009. 6:45 PM [REPLY](#)



Kaiouss says:

It's probably fine in the sense that the tin won't melt, but if you're putting more weight than the surface area of the bottom of the can will support, then it might fall through. Only one way to find out! Or, at least, only one dangerous way. Which is pretty much the same as there only being one way.

Sep 10, 2009. 9:50 AM [REPLY](#)



Fenris The bbw says:

No idea. It'll probably work out fine. If the can eventually falls through, just use a new one.

Aug 20, 2009. 6:22 PM [REPLY](#)



edfel01 says:

ya i cut my finger and i think it went to the bone bc its gushing...so like he said safety!!!

Aug 23, 2009. 2:58 PM [REPLY](#)



Fenris The bbw says:

Lol. Have fun in the hospital. Hope the stitches don't hurt.

Aug 25, 2009. 7:25 PM [REPLY](#)



SeverinR says:

The coals on the side and bottom hold the can in place. Should one of them shift, the can isn't going to tip over, and it shouldn't move enough to cause a splash, but using a metal spacer or insert would prevent most instability. But it can't be aluminum

Aug 6, 2009. 12:20 PM [REPLY](#)



goodinstructabledude says:

What happens when you don't hold your breath?

Jun 27, 2009. 6:16 PM [REPLY](#)



SeverinR says:

its called metal fume fever. The galvanized steel cans produce fumes and probably the impurities of the aluminum do too.

Aug 6, 2009. 12:10 PM [REPLY](#)



Fenris The bbw says:

You get a little nauseous the next day. Probably something worse in the long-run though. If you melt clean aluminum, you shouldn't have a problem. Aluminum cans have coatings of plastic and paint on them though, so they produce noxious fumes when burned.

Jul 3, 2009. 12:54 PM [REPLY](#)



gusew says:

I saw once that you could TIG (GTAW or gas tungsten arc welding) weld two soda cans together...so i tried it in my welding and metal fab. class and the cans just melted and smelled horrible causing a bad headache.

May 4, 2010. 5:49 AM [REPLY](#)



magickaldan says:

I've seen a demo showing one melting a penny. It was pretty cool. Was along time ago and don't know where it was. Didn't look like the reflector was that big.

Aug 1, 2009. 8:06 AM [REPLY](#)

[view all 264 comments](#)