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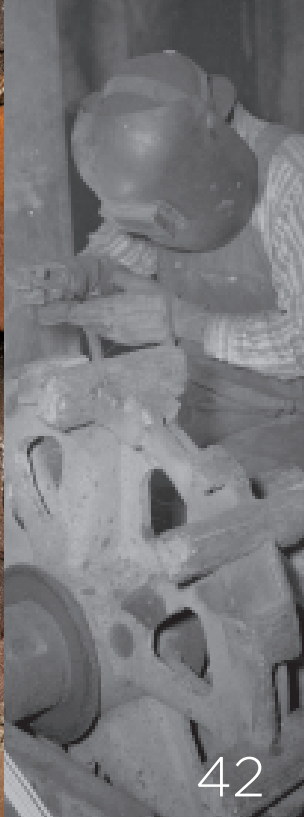
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## Publisher

Craig Coffey  
publisher@arcmagazine.pub

## Editor

John C. Bruening  
editor@arcmagazine.pub

## Associate Editor

Ken Krizner

## Art Director

Emily Rigo  
design@arcmagazine.pub

## Advertising Manager

advertising@arcmagazine.pub

## Digital Media Manager

apps@arcmagazine.pub

## Circulation Manager

circulation@arcmagazine.pub

## Production Manager

Erin Abed  
reprints@arcmagazine.pub

## Photographer

Jenny Ogborn  
photos@arcmagazine.pub

## Designers

Travis Lefelhoc  
Karen Ludlow  
Anthony Schneider



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## CONTRIBUTORS



Jeff **Herrington** **Writer**

A Dallas-based writer, Jeff Herrington has traveled to more than 40 countries on five continents. His interview subjects include a prime minister of New Zealand, a top heart surgeon in France and the CEO of Argentina's state oil company, as well as hurricane-ravaged business owners and Nazi-occupation survivors. Along the way, he's climbed Sri Lankan ruins and reported on a Japanese ice festival in below-zero weather. His first mystery novel, *Murder in Manhattan*, debuted in December and the second in the series, *Murder Becomes Miami*, will be published this fall.



George C. **Willard** **Applications Engineer**

George C. Willard works in Applications Engineering at Lincoln Electric. He assists customers by recommending welding processes and filler metals, and he develops welding procedures in the company's welding lab. He holds a bachelor's degree in welding engineering from The Ohio State University, has worked at Lincoln Electric since 2010, and was previously a shop supervisor for 12 years.



Jimmy **DiResta** **Fabricator**

Jimmy DiResta is a New York-based artist, designer, master builder and video producer. His work has been showcased on Discovery Channel, HGTV, DIY and FX, as well as YouTube. His goal is to educate and inspire people to embark on their own home projects in an entertaining way. His unique builds are comprised of many different materials and processes. With his artisan skills and a shop full of power tools, he lets the build process speak for itself.

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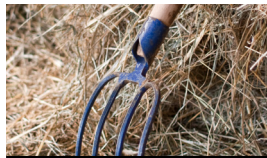
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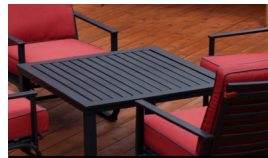
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# LETTER FROM THE EDITOR

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## MAKING SPIRITS BRIGHT

► In what seems like the blink of an eye, another year winds down at *ARC Magazine* and Lincoln Electric, and another holiday season gets into high gear. We hope 2017 has been a good year for you and whatever welding and fabricating ventures you've pursued, and we hope we've been able to help in some small way.

In the process of planning our winter issue, it seemed appropriate to feature a jolly fellow with a big beard and an infectious laugh – someone who builds fun things in his workshop, has traveled all around the world at least a few times and has a history of doing good things for kids. Santa wasn't available – and he's probably not the best match for our target audience anyway – so we found the next best thing in Lou Santiago.

Lou is a rare combination of virtues – incredibly knowledgeable and vastly experienced in custom building, and also one of the most easygoing, down-to-earth people in the business. The charismatic personality, combined with four decades of experience and an encyclopedic grasp of all things automotive, have translated well to TV, ever since he began hosting Spike TV's *MuscleCar* in 2005, and later with *Ultimate Car Build Off* and *Car Fix*.

Casey Smith, who teaches automotive restoration with Lou at Central Piedmont Community College in Charlotte, North Carolina, sums up his co-instructor very simply: "He's someone who connects with you whether you're 18 or 80." Lou may not be Father Christmas, but his



seemingly endless supply of good cheer and goodwill are perfect for this season or any other.

If there's something about Lou and his story that inspires you to get some welding gear of your own and get busy, we can help with that. Our annual Buyers Guide in this issue includes equipment and accessories to get you started – or keep you going – in stick, TIG and MIG welding as well as plasma cutting. Some of the items may be too big to fit under your tree, but that shouldn't stop you from getting whatever you need to start welding and embrace the maker experience as 2018 gets under way.

Thanks for being a member of the ARC community this year and providing

helpful feedback along the way. We wish you the best of the season and much success in 2018. As always, we're here to listen, inform and inspire, so be sure to keep in touch.

Happy holidays!

— **John C. Bruening, Editor-in-Chief**  
[Editor@arcmagazine.pub](mailto:Editor@arcmagazine.pub)

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*The communication channel is always open at ARC Magazine, and we welcome your feedback about what you see or what you'd like to see on these pages. Contact us at [editor@arcmagazine.pub](mailto:editor@arcmagazine.pub) or [publisher@arcmagazine.pub](mailto:publisher@arcmagazine.pub).*

# WE WELCOME YOUR FEEDBACK!

Email us at [editor@arcmagazine.pub](mailto:editor@arcmagazine.pub). Please include your mailing address. If we print your letter, we'll send you a free Lincoln Electric baseball cap or *ARC Magazine* t-shirt!



We reserve the right to edit responses for the sake of grammar, appropriateness and/or available space.

**CORRECTION:** Paul Teutul Jr.'s name was spelled incorrectly on the cover of our Fall 2017 issue. We regret the error.

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# ASK THE EXPERTS

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Welding experts at Lincoln Electric answer your questions about equipment setup, processes, techniques, safety and more.

Looking for guidance with technical issues? Contact us at [questions@arcmagazine.pub](mailto:questions@arcmagazine.pub)

## How do I determine the most efficient pressure settings for my oxygen and fuel gas regulators?

- Neiten Perez, City and State Unknown

► You don't want to assume anything, so you should always follow the torch manufacturer's recommended tip chart. You will have chart recommendations for pressure settings and tip size. Generally speaking, as the material gets thicker, you have to increase the oxygen pressure to maintain that percentage, or you lose the cut. All manufacturers are different, so you can't necessarily apply the recommendations from one manufacturer to a regulator made by another. If you do, you could be wasting gas by burning it up unnecessarily, or you could overheat the tip. The tip may not be able to withstand that level of heat or pressure, and something will have to give. To avoid potential problems, always follow manufacturer-rated recommendations.

## I'm having trouble welding with 308L flux-cored dual-shield wire, specifically while welding 304 SS frames. While welding in the flat and vertical positions, it's business as usual. However, when transitioning from flat to vertical, I can't seem to get the crotch of the weld to wet/lay in nice and fluid. Any advice?

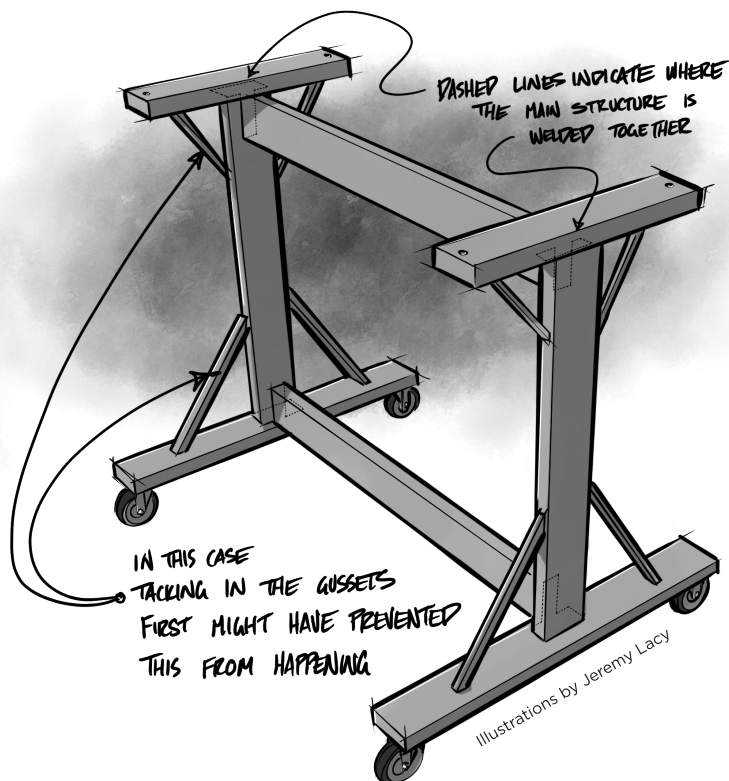
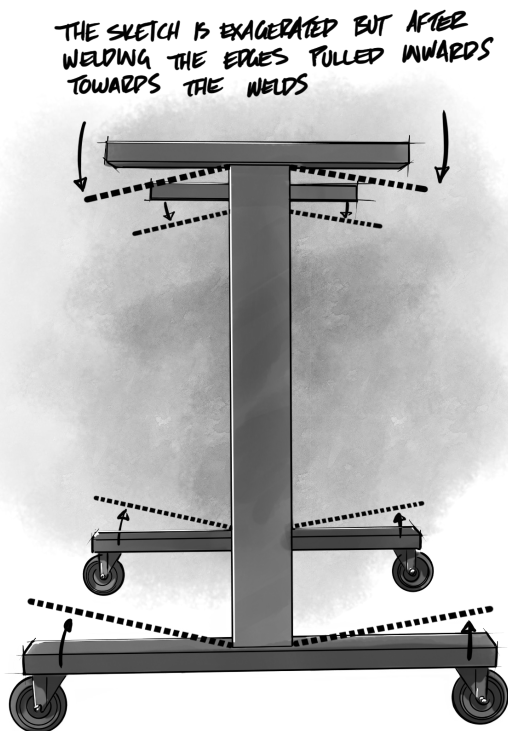
- Eric Pescetta, Ludlow, Massachusetts

► It's hard to give specific advice without watching your technique, but it's likely that you're waiting too long to bring the gun angle up from flat to vertical as you approach the corner. Increasing your gun angle sooner will probably enable you to lay in a better weld.



## IF YOU HAVE QUESTIONS ABOUT WELDING, HERE'S YOUR CHANCE TO GET CLARITY.

Submit your question to [questions@arcmagazine.pub](mailto:questions@arcmagazine.pub), and be sure to include your full mailing address. If we use your question, you'll get a FREE Lincoln Electric baseball cap or ARC Magazine t-shirt. Feel free to submit more than one question, but please be specific; the more details you provide, the more likely we are to use your question.



**I recently MIG welded a base for a 3-in-1 tool using 14-gauge 3-inch x 1-inch cold rolled steel scrap. I ground all the areas of each piece to be welded, then tacked everything together. I tacked opposite corners of each piece to keep the heat from pulling it out of square. But as I began welding all the pieces together, the heat still warped some of the pieces as shown in the attached sketch. My question is: When laying long welds on a piece where there will be a lot of heat buildup, how would you typically keep something like this from happening?**

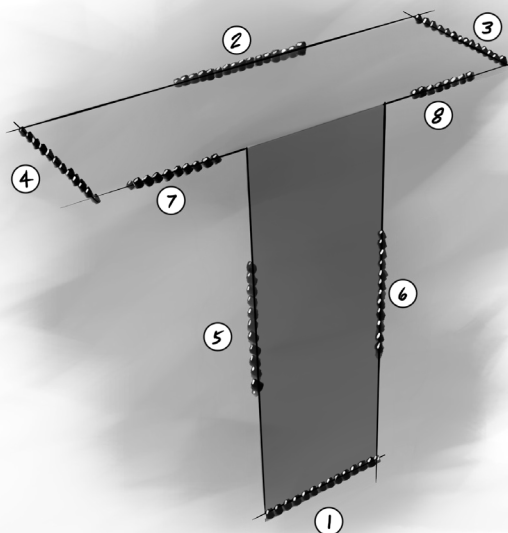
*- Jeremy Lacy, Denver, Colorado*

Your best bet would have been to weld the gussets first. If you start welding the horizontal and vertical pieces of the frame without first securing the gussets, there's nothing to hold the pieces in place and keep everything square.

Once the gussets are welded, you can weld the rest of the frame. You essentially have a T-shape at a 90-degree angle at each of the four points where the horizontal and vertical pieces connect. Tack each of these points first, then skip weld them in a specific sequence as shown in the diagram. Again, you'll want to alternate around the four connecting points to avoid generating excessive heat in any one spot. When you get to the edges of this T shape with your weld, be sure to wrap the corners.

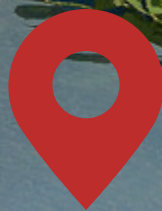
Also, a project like this is best done with short arc, using 0.035 inch. wire and a 75/25 gas mixture. Short arc will accommodate just about any metal thickness, all the way up to 3/16 inch.

*(Editor's note: Jeremy Lacy, who submitted this project question, is an industrial designer and builder of custom motorcycles. His illustrations appear regularly in this column and elsewhere in ARC.)*



# WERE THE WORLDS CARMAN SANTIAGO?

By Jeff Herrington



REST ASSURED WHEREVER  
CABLE STAROUS SANTIAGO GOES,  
SPARKS ARE SURE TO FLY.



GARAGE TALKER TV.COM





He's lived in the South Bronx, Long Island, Gulfport, San Diego and (now) North Carolina.

He's worked in 17 countries, from Thailand and Bahrain to the Philippines and Saudi Arabia.

He's also hosted three wildly popular car-building shows — not one but two cable networks.

And yet, despite his globetrotting legacy, Lou Santiago isn't the type of celebrity who has a chauffeur and jet at his beck and call. In fact, he doesn't fly at all if he can avoid it.

Instead, Santiago's a man who, at 54, is finally settling into a comfortable groove. As a husband and father of four. As an adjunct lecturer at Central Piedmont Community College in Charlotte, North Carolina. And as a master car builder working out of a backyard shop whose interior resembles the testing site for a nuclear blast.

"I've racked up lots of mileage over the years," he confesses. "But these days, that shop is my favorite vacation destination."



It's an August day in North Carolina, and the air is sultry and the wind is slack. The ravages of Harvey and Irma throughout the Southern states are still a few weeks in the future. Santiago's shop feels like the inside of a kiln because, well, it's made of metal and isn't air-conditioned. It does, however, boast two television sets which (depending on the time of day) feed Lou his daily dose of the iconic fantasy series, *Supernatural*, or the equally iconic animated comedy, *SpongeBob Squarepants*. Tools are everywhere. Absolutely everywhere.

"I especially love chassis work because not many are doing it, especially here. I have this info trapped in my head about where I want to sit in a vehicle, how to make it not ride like a logging truck. The minute someone says to me, 'You can't do that,' I need to show them that yes, I can."

Born in the South Bronx and raised on Long Island, Santiago has worshipped cars and trucks pretty much since the day he first climbed into one. He fondly recalls his ironworker dad purchasing a light-blue '58 Chevrolet Delray. "It was amazing," he says, "but then some guy hit us underneath one of the elevated railways. Dad decided we'd just remove the license plate, leave the car there and ride that subway home."

That episode taught Santiago that if he wanted to have a car — a really cool car — he'd have to construct it himself. So at age 13, he teamed up with a street-racing buddy to build budget cars and explore the wild, woolly world of creative fabrication. His unstructured approach to education eventually gave way to his joining a two-year program in diesel mechanics at Uniondale High School.

But it was after high school, when he joined the U.S. Navy, that he discovered his true passion: working on heavy equipment.

"For 16 years, I was a Seabee mechanic servicing the equipment used by Navy Seal Team Eight," he says. "My world was earth movers and cranes. Cars were just a hobby. And my custom-fabrication background came in handy, since parts were often hard to come by."

Back surgery brought Santiago's Navy career — and his work with heavy equipment — to an end. But it didn't end his connection to rebuilding things. He relocated his

family to North Carolina and started rebuilding his muscle-car fabrication business. And thanks to earning a degree in human behavior from Central Piedmont Community College, he went from rebuilding the engines inside big rigs to rebuilding the ethics inside little kids.

"I wanted to go into nursing, but couldn't pass chemistry," he says. So he took a job at a school for at-risk kids as a behavioral management technician (or as he puts it, "the muscles a kid had to contend with if he hit a teacher"). Especially memorable: The day he persuaded six students to relinquish the knives and shanks they'd brought to class as part of a plot to take over the school.

Santiago then accepted an internship at a juvenile justice center, where he met an 8 year old with a troubled track record. "This kid would show up at the juvie jail carrying his clothes in a trash bag," he remembers. "Turns out, he was getting into trouble because his mother wouldn't take her medication and he was making all the decisions for the family."

you survive. I don't ever want to be off my game."

Fortunately, Santiago tends to land on his feet even when he's not "on his game." Consider the almost accidental way he became one of cable television's most popular hosts. He was in his shop, searching online for a four-link calculator he could use to determine the angles required for the suspension of a car he was working on, when he spotted an ad for a TV host. "I answered all the application's stupid questions and it wouldn't let me go to the next page. So I punched 'enter' and forgot about it. A week later, I got an email from some company whose name I didn't recognize, so I ignored it for a month."

Turns out the email was from the production company that had run the ad. They'd received his application after all, and they wanted him

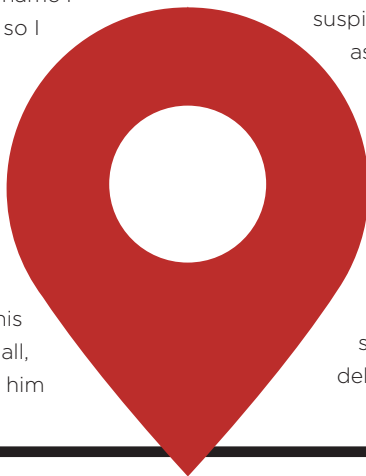
No one was more surprised by the accolade than Santiago himself.

"Everything I know I've either researched or figured out on my own," he says. "I've never considered it voodoo. Once, I told Jared, 'I'm just some guy in a shop who builds cars.' He replied, 'No you're not, Lou. What you produce is what we produce at Rad Rides by Troy.'

Santiago has subsequently polished his reputation as an opinionated but accomplished car-builder on Discovery Channel's *Ultimate Car Build Off* and *Car Fix*, in its seventh season on the Velocity Channel. He's become a fixture in an industry he once was

suspicious of and still avoids as entertainment.

"So many car shows are about the fake drama and deadlines," he says, "with a host who's more of a TV guy than a car guy and a producer who's more about showing sparks than delivering quality



## "THESE DAYS, THAT SHOP IS MY FAVORITE DESTINATION."

One might think dealing with delinquents and death-row candidates would harden Santiago's spirit. It had the opposite effect.

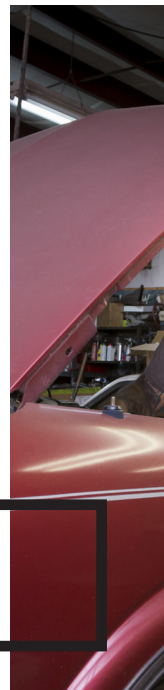
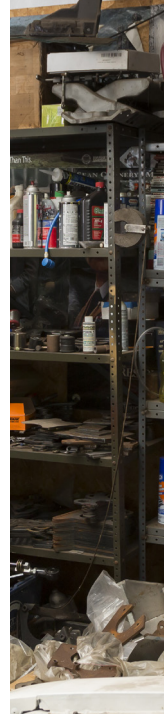
"I deal better with people now," he says. "Growing up, I was prone to violence, but working with those kids softened some of the edge, made me more compassionate." And he's not entirely sure that's a good thing. "Because too much compassion can get you killed," he says, suddenly animated. "Because how you react in the first 10 seconds of a dangerous situation dictates whether

to shoot a five-minute video and travel to Tennessee for a screen test. He got the job, and within months, he was becoming one of television's most recognizable and popular personalities as host of Spike TV's *MuscleCar*. Santiago rebuilt classic muscle cars from the ground up, and explained their original fabrication, alongside co-host Jared Zimmerman of the Illinois-based automobile fabricator Rad Rides by Troy. Before Santiago had finished filming his final episode of *MuscleCar*, people were calling him the car world's automotive encyclopedia.

information. They're better now, but I never watch them."

Millions of people, however, do watch Santiago on *Car Fix*. Matt Allegretti, the show's director and producer, believes there's a growing appetite for authenticity that explains Santiago's huge popularity.

"Lots of hosts try to prove they know more about cars than the viewer," says Allegretti. "But our viewers want a relatable host — someone who really knows cars and can stroll into a neighbor's garage and make car work fun to watch. That's Lou."

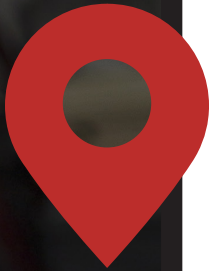




*Santiago developed his fabrication skills when he was just a teenager, then put them to good use as a Seabee mechanic for U.S. Navy Seal Team Eight for 16 years.*



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Allegretti adds: "The show isn't scripted and he's all organic. He's even mentioned on-camera some product detail he overheard us discussing prior to filming. Our viewers really appreciate that spontaneity."

think they know it all, to go talk to Lou. And yet, although he's a celebrity, he came to my retirement party. He's that type of guy."

Sitting in Lee's Sandwich Shop near his home, and munching on a hickory

## **THE PERFECT BALANCE OF KNOWLEDGE, EXPERIENCE AND HILARITY: "HE'S SOMEONE WHO CONNECTS WITH YOU WHETHER YOU'RE 18 OR 80."**

On the side, Santiago teaches a restoration class at Central Piedmont Community College. His co-instructor, Casey Smith, agrees that the Lou you see on television is the Lou you get in person.

"We joke about how I thought he was an outlaw when I met him because of his bandana and tattoos," Smith says. "Turns out, he's someone who connects with you whether you're 18 or 80. And he has this amazing way of making suspension work seem simple. He flips switches in people's brains the way other people flip light switches."

There's also his laugh — a deep, never-ending eruption of hilarity that sounds like a semi barreling full-throttle downhill. It's a laugh you can't escape or ignore — and why would you want to?

"When he's teaching, Lou cracks jokes, so you get a lot of his big laugh in the classroom," says Henry Bennett, former chair of the college's collision repair program. Bennett and Santiago met at an auto fair. Santiago offered the college his help, so Bennett brought him in to teach a welding class.

"Lou's style is relaxed, but his knowledge is incredible," says Bennett. "I tell people that if they

bacon cheeseburger, Santiago insists he sees no retirement party in his immediate future. He thinks he's got an abundance of car-building knowledge left to share — with college students, the car enthusiasts who visit him at [Garageinsidertv.com](http://Garageinsidertv.com) and his many television fans.

"I want people to understand there are at least a hundred ways to do something, not all of which are right," he says. "I want to help people learning from me not just what to do, but also what not to do."

And although he's slowed down, "I still have a deep need to build," he says. "These days, my inspiration comes from wanting to do my trade better."

And he's yet to fulfill his lifelong dream of owning a really cool car.

"Someone stole my first cool car, and I lost the second one somehow," he says. "I got a third when I started *MuscleCar*, but I used it to pay a debt. Right now, my Moby Dick is a 1967 Impala."

Should he acquire that car, it might very well put him back on the road and have his fans wondering yet again, "Just where in the world is car man Santiago?" **ARC**



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# 2017 BUYER'S GUIDE

The holiday season is upon us once again! To help you find the perfect gift for the welder, maker, craftsman or hobbyist in your life, the staff at *ARC Magazine* put together our 2017 Buyer's Guide. Now, everything they always wanted is at your fingertips—and can be found at your local welding distributor or direct from Lincoln Electric online!



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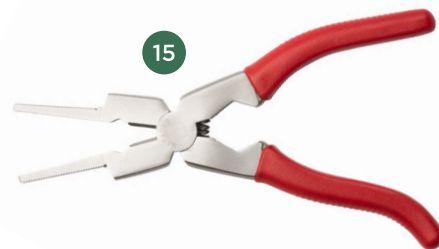
# MIGWELDING



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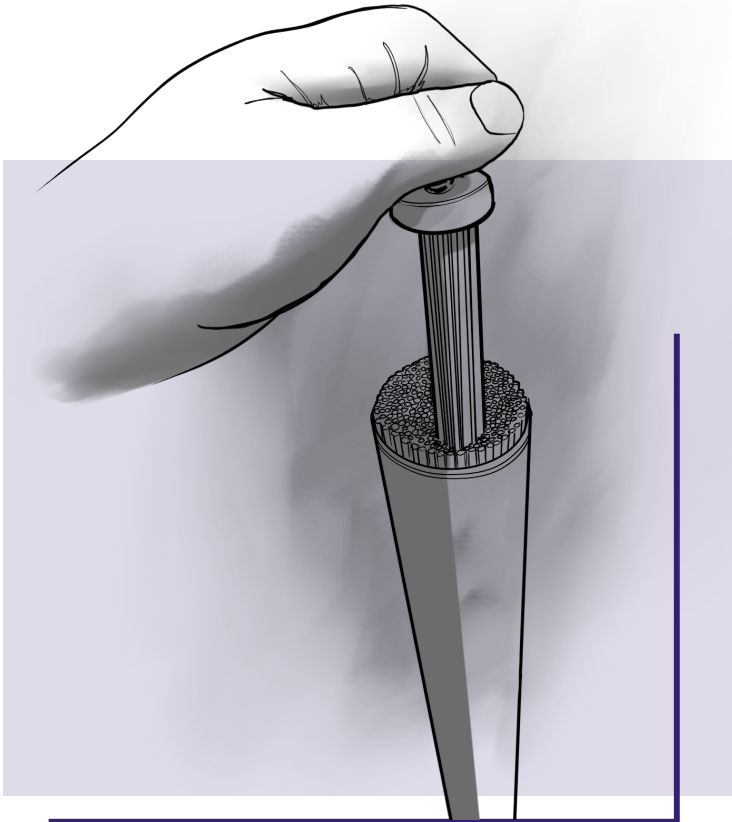
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# BEGINNER TIPS & TRICKS

Make It Easier to Weld Your Workpiece.



Illustrations by Jeremy Lacy

## MAGNETIC ACCESS

- EDDIE GIRVAN, FLORENCE, TEXAS

▶ Instead of struggling to get welding rods out of a newly opened can, use a magnet to pull them out. You'll get a handful each time, and the remaining rods will soon be easy to remove.

## PATCH WITH A THICKER GAUGE

- JAMES HOFF, COLORADO SPRINGS, COLORADO

▶ When welding in small patches where you cut out rust on body parts, use a slightly thicker gauge metal for the patch. That way, when you start to weld the patch the majority of the heat will be kept on thicker metal. This works really well if you have access to the back.

## HAVE A TIP OR A TRICK YOU'D LIKE TO SHARE WITH BEGINNERS? LET US KNOW!

Send your tip or trick to [questions@arcmagazine.pub](mailto:questions@arcmagazine.pub) and we just might feature it in an upcoming issue!

Feel free to submit more than one tip, but please be as specific and detailed as possible. The more details you provide, the more likely we are to use your tip. Note: We reserve the right to edit responses for the sake of grammar, appropriateness and/or available space.

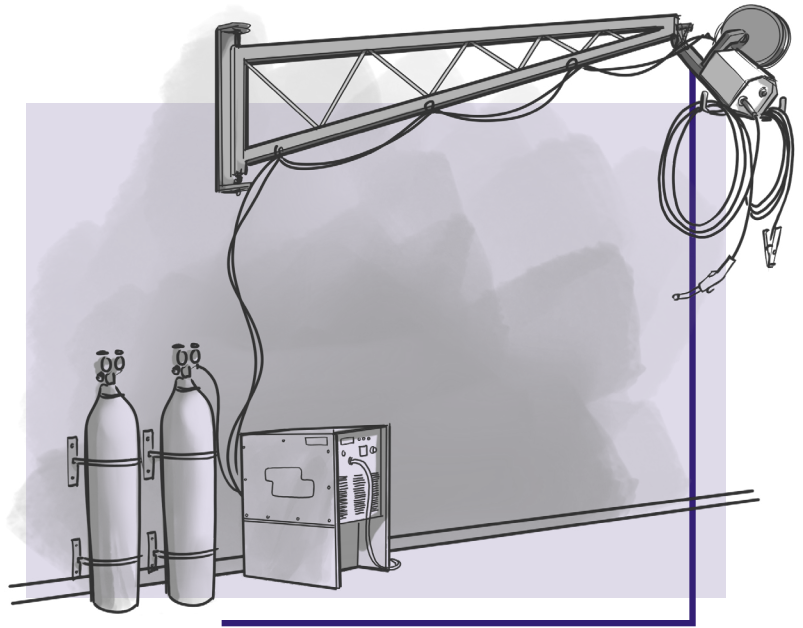
And ... if we do use your submission, we'll send you a FREE Lincoln Electric Welding Gear Ready-Pak®.



## AVOID ENTANGLEMENTS

- CHRISTOPHER WILKINS,  
RALEIGH, NORTH CAROLINA

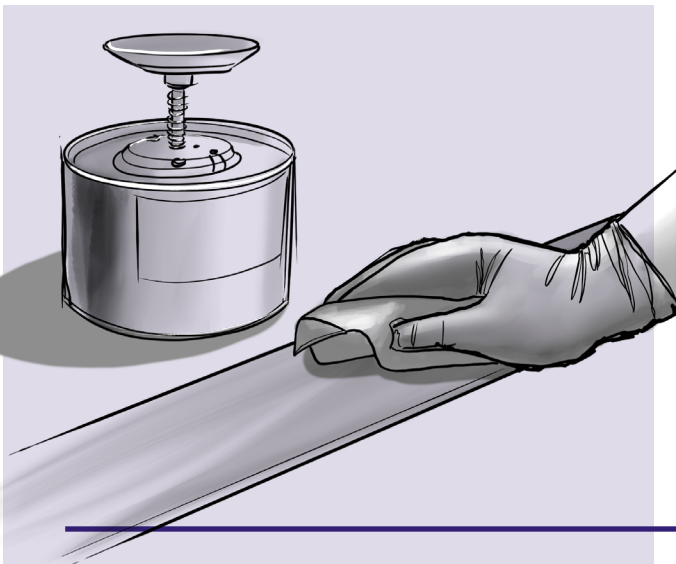
► To increase productivity by reducing the amount of time every day that I was spending untangling my torch lines, my manager and I built our own weld boom to get our cables off the floor. We use it to lower the torch wherever we need it. This not only saves time, as I am no longer fighting with tangles, but it also helps save wear and tear on our equipment and keeps the torch from hitting the floor and breaking the gas cups. Make sure when you build your own, it matches your welding machine.



## RECOGNIZE THE WELD PUDDLE

- ANDREW LAMER, COTTONWOOD, ARIZONA

► Make sure you can see the arc and recognize the weld puddle. Once you can see and recognize that weld puddle, you can control it. The weld puddle can tell you if your work or travel angles are wrong and whether you're traveling too fast or slow. If you are having trouble keeping your weld in the groove it might just be a matter of moving your head into a position where you can see the arc and weld puddle.



## A SMALL TAB FOR A LARGER PIECE

- JEFFREY KEPIRO, ROCK CREEK, OHIO

► When you need to weld a small tab — such as 1 inch X 1 inch x 1/4-inch thick — to a larger piece, mark out the tab on a longer piece of material, drill any necessary holes in it, then cut with a bandsaw. Leave a small amount of material to hold the tab to the larger piece. You can produce many small tabs, but be careful not to cut them all the way off the larger piece. Then weld or tack firmly in place using the longer piece as a handle to hold in position, and then snap them off as you grind the corners after welding. This works with many types of material.

## CLEAN ON ALL SIDES

- JERRY MOSES, BOSTON, MASSACHUSETTS

► Aluminum is a wonderful metal to weld. But there is one primary rule that must be followed to successfully weld aluminum: It must be clean. Always clean and degrease the material and don't forget to wipe the opposite side of the joint as well to make sure impurities are not pulled through the aluminum and into the weld puddle.

# EDUCATOR SPOTLIGHT

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## ALLAN COLLINS

### DEAD-LEVEL BEST

*By John C. Bruening*

Allan Collins believes everyone deserves a second chance. He's fiercely committed to making sure every one of his students gets one.

Collins teaches welding, cutting and blueprint reading at the Ellsworth Correctional Facility in Ellsworth, Kansas, a site that houses approximately 925 male inmates. An employee of Barton Community College in Great Bend, Kansas, Collins has been teaching at ECF for the past six years

"I love to teach welding," says Collins. "I have a passion for it. And I get paid to do this, so it's just the greatest job in the world for me. I'm 62, and I'm planning on doing this until I'm at least 68 or 70. I'm not even thinking about retirement at 65. I'm going to do it as long as my health holds out and the college and the correctional facility are happy with me."

Collins received his initial welding training in high school in the 1970s. After high school, he spent several years as a welder and mechanic for diesel trucks and heavy construction equipment before transitioning into a job as a welding instructor for the Juvenile Justice Authority for the state of Kansas in the early 2000s.

He took a part-time teaching position at Barton College in 2012. Barton arranged for Collins to teach evenings at the college's main campus and days at ECF. Since January 2016, he's begun teaching at ECF full-time.

The Ellsworth facility - and indeed, the state of Kansas overall - apparently have been happy with Collins' work ethic. At a ceremony at the State Capitol Building in Topeka in June 2017, Kansas Governor

Sam Brownback named Collins the Kansas Department of Corrections Outstanding Contract Employee of the Year.

When Collins talks about the enormous responsibility that comes with teaching inmates a skill that will hopefully change their lives for the better, his sense of commitment is almost palpable. He recalls a phone call from the mother of an inmate to Joseph Norwood, secretary of corrections for KDOC. The mother was desperate to get her son into Collins' class because she knew it would put him on the right path.

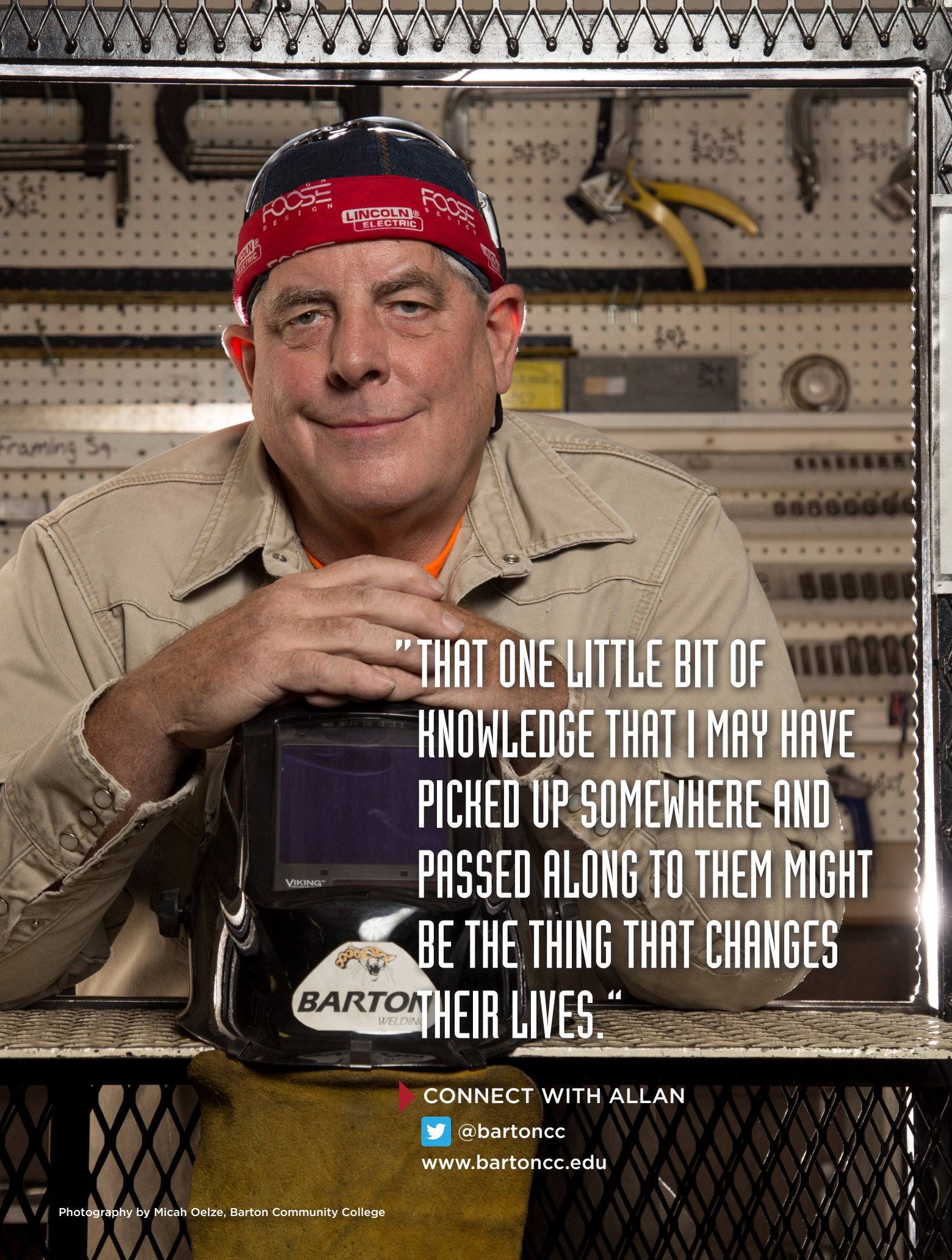
"It's things like that that I think about every morning," says Collins, his voice faltering. "And that's what drives me to do my dead-level best every day."

Mike Williams, an inmate at ECF and one of Collins' former students, was the first to give *ARC* a heads up about Collins in a letter he wrote to the magazine in the fall of 2016.

"I started as a student in the welding program on the first of August," wrote Williams, who finished his classes at the end of 2016 and is currently working to become a tutor within the program. "It has already changed my life dramatically. My whole view of the future has changed. I don't just get through my days now. I have hope. I have purpose."


For Collins, the most challenging part of the job is also the most rewarding. "I just want to make sure I give them all the knowledge that I've learned over the last 44 years," he says, "because that one little bit of knowledge that I may have picked up somewhere and passed along to them might be the thing that changes their lives." **ARC**





“THAT ONE LITTLE BIT OF KNOWLEDGE THAT I MAY HAVE PICKED UP SOMEWHERE AND PASSED ALONG TO THEM MIGHT BE THE THING THAT CHANGES THEIR LIVES.”

▶ CONNECT WITH ALLAN

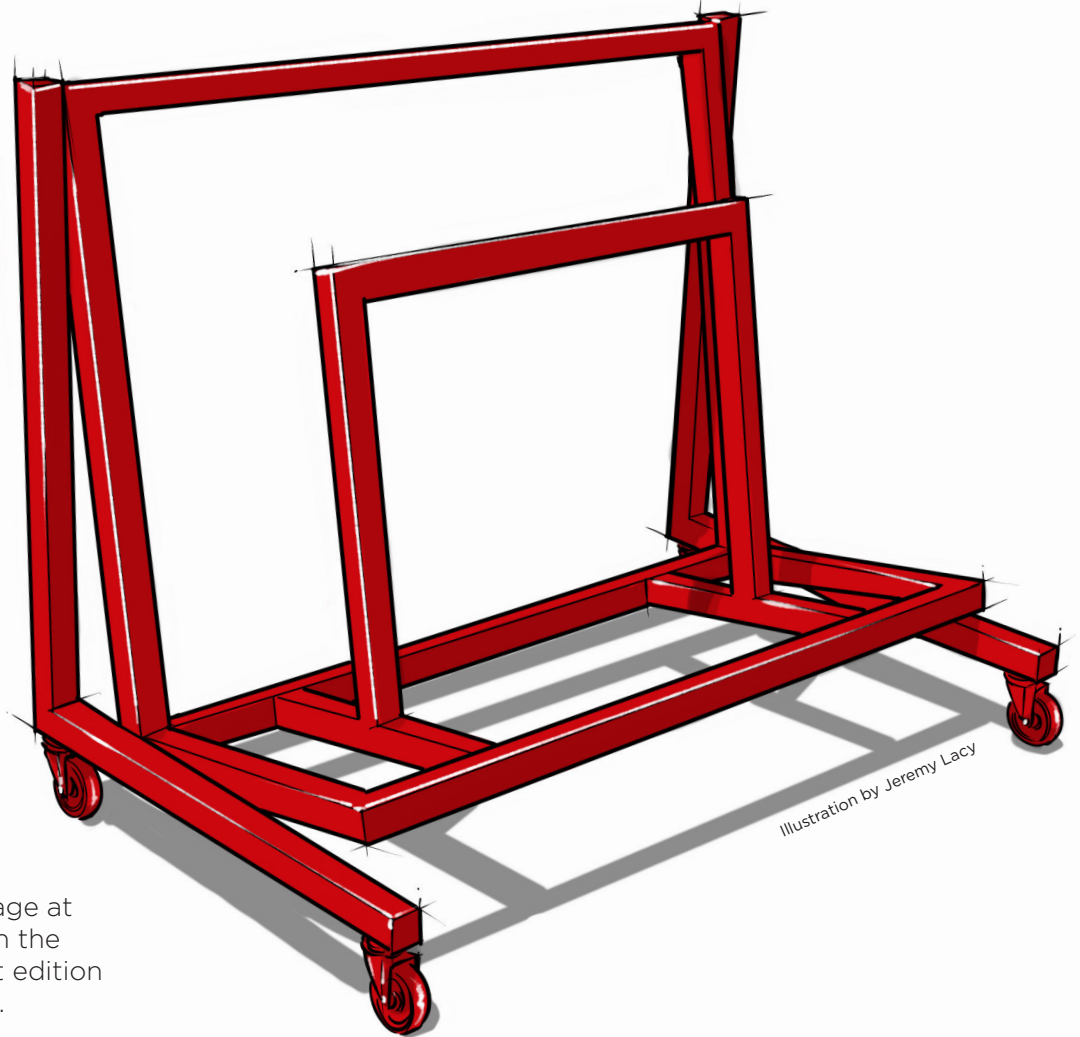
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# Project Spotlight

## A LUMBER CART FOR THE WORKSHOP

By Jimmy DiResta



Watch exclusive footage at [arcmagazine.pub](http://arcmagazine.pub) or in the *ARC Magazine™* tablet edition (download it for free).

Sorting through materials scattered all over the shop is a sure fire way to slow down any project. If you're a weekend warrior with limited time to work, having a way to organize and deliver materials to your work location is event more vital.

In this project, craftsman and maker Jimmy DiResta explains how to build a lumber cart that can hold hundreds of pounds of plywood and cut-offs for easy access and mobility. This is a build that can be

both functional and attractive and give any do-it-yourselfer a leg up when building future projects.

As with any project, materials and designs are entirely up to the maker. But no matter what materials you use, following these steps will lead to a practical and handy addition to any workshop.

All of the design files and specs can be found at [arcmagazine.pub](http://arcmagazine.pub).



© Jimmy DiResta

## SAFETY FIRST

Before you start any project involving welding, make sure you have the right Personal Protective Equipment (PPE), which includes, at least, an ANSI-approved welding helmet, safety glasses, appropriate welding gloves for the process you're using, and a flame-resistant shirt, jacket, or sleeves to protect from UV rays and burns. You should also keep a fire extinguisher close at hand. Use adequate ventilation when welding. A properly approved respirator should be used whenever fumes may enter your breathing zone and general area.

## REMEMBER:

As is required, always be sure to keep combustible materials such as wood, paper and plastics at least 35 feet away from the welding arc, cutting or grinding operations.

## MATERIALS

Approx. 48 ft of 2-inch, 16-gauge box tubing

Approx. 36 inches of 1 1/2-inch, 16-gauge flat stock

Heavy duty casters

## WELDING/CUTTING EQUIPMENT AND TOOLS

Lincoln Electric POWER MIG® 210 MP

Bandsaw with metal-cutting blade

Angle grinder

Cutoff wheel

Flat grinding disc

36-grit sanding disc

Vice grips

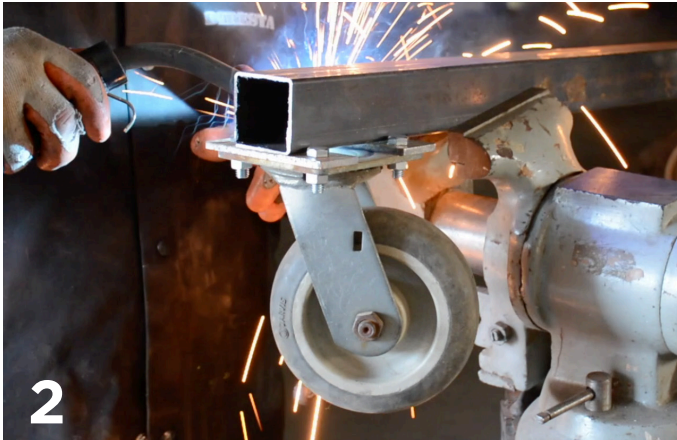
Drill

Bolts

Clamp

Hammer

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## Step 1: Build the Outer Frame Legs

All of the frame components are welded using lap joints at each corner. Weld up two L-shaped “legs” with a vertical measurement of approximately 4 feet and a horizontal measurement of approximately three feet.

## Step 2: Caster Carriages

Create caster “carriages” by bolting appropriate lengths of 16-ga. flat stock to the casters. This will allow easier removal of the caster if needed later. Weld the caster carriages to the four corners of the frame legs.

## Step 3: Build and Attach the Outer Corral

Once again using lap joints, create an L-shaped outer frame or corral. The approximate dimensions are 4 feet high by 6 feet wide, with the lower leg of the L measuring approximately 2 to 2 1/2 feet. This inner frame will be attached to the outer frame legs. Clamp the outer frame to the legs at an approximately 10 degree angle. This angle will keep sheet goods leaning against the back of the cart.

## Step 4: Add Cross Members

At the base of the inner frame, two stretchers will need to be added. These will enable you to slide sheet goods across the cart and will accommodate the front corral. These cross members should be welded about a third of the width of the inner frame. In other words, if your frame is 6 feet wide, the cross member will be welded in at 2 feet from each side.



## Step 5: Add the Inner Corral

Working from the cross members up, weld two two-foot-tall uprights and a cross piece in place in the shape of an upside down U about a foot from the back of the frame. This inner corral piece will keep sheet goods from sliding off the cart.

## Step 6: Add Bracing

Weld angled gussets from the inner frame to the outer frame at the base of the cart. This will provide rigidity and will help transfer the load to all four wheels.

## Step 7: Prep for Finish

Just because this art is going to be in the shop, doesn't mean it has to be an eyesore. Take the time to cap all of the open tubing, grind down any welds that need it, and wipe everything down with mineral spirits or acetone to prep for finish.

## Step 8: Apply Finish

Apply two coats of a good quality metal primer to the entire cart, followed by the two to three coats of finish. Because of the sharp angles of this cart, I recommend a high visibility color like orange, but the choice is up to you.

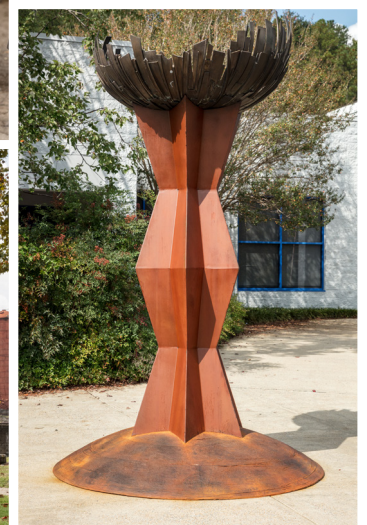
▶ A detailed drawing and cut list for this project can be downloaded at [arcmagazine.pub](http://arcmagazine.pub).



## AN IRONCLAD LEGACY

The industrial heritage of Birmingham, Alabama, is directly connected to Sloss Furnaces. For nearly a century, the Sloss blast furnace produced iron from its foundry, creating jobs and spurring economic growth. Changing conditions forced the complex to shutter as a commercial enterprise in 1974.

However, thanks to Birmingham residents, the site was saved and designated as a National Historical Landmark. Today, artists such as Ajene Williams, Marshall Christie and Ira Hill (pictured below, from left to right) use the molten metal from Sloss' blast furnace to create cast iron sculptures, and the Sloss Metal Arts program presents myriad opportunities to learn about casting, fabrication and forging. At the same time, Sloss Furnaces provides an important link to the legacy of Birmingham's industrial past. **ARC**





Photography by Cary Norton

# Master Class

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**A discussion of advanced materials and techniques  
for the seasoned welder.**



*The submerged arc welding process involves a single arc wire or multiple arc wires. Adding more arc wires generates higher deposition.*

# USING THE SUBMERGED ARC WELDING PROCESS

By George C. Willard

Submerged arc welding is a high-deposition, high-penetration process. Similar to MIG welding, the submerged arc process involves the formation of an arc between a continuously fed copper-coated wire electrode and the workpiece.

The biggest difference, however, between submerged arc and MIG welding is in the protection of the weld. MIG welding requires shielding gas. When welding with the submerged arc process, granulated flux shields the arc from the atmosphere, and it also protects the operator.

Operators can run the submerged arc welding process for long, straight, continuous welds on large, heavy weldments in applications such as shipyards, heavy construction and heavy fabrication. Another application where submerged arc may be preferred is on large roundabouts, such as for pressure vessels and steel mill caster rolls. In some applications, the material can be as thin as 1/8-inch or even thinner.

The material can be joined by using direct current electrode positive (DCEP), direct current electrode negative (DCEN) or alternating current (AC) power. DCEP is the most stable and has the highest penetration of the three waveforms, while DCEN provides the most deposition but with less penetration and less stability. An AC wave can be manipulated to give the best balance between DCEP and DCEN for each application.

Because submerged arc welding requires a granulated flux and produces a large puddle and slow freezing slag, it is performed only in the flat and horizontal positions.

The submerged arc welding process usually takes larger diameter wires compared with other processes, typically 3/32 inch through 3/16 inch, so operators can achieve high travel speeds and high deposition rates.

Prior to welding, a layer of flux is placed on the surface of the workpiece. The arc moves along the joint line, melting some of the flux into a liquid slag. The layer of slag and flux completely covers the molten metal to protect the molten weld pool from the atmosphere, prevent spatter and sparks, and suppress arc rays and fumes.

Submerged arc welding is a single or multiple arc process.

In the single arc process, the metal pieces to be joined are usually positioned tightly together (sometimes with a back-up bar). Operators encountering gaps should reduce penetration by lowering the current. While single arc will cover most applications, multiple arcs achieve higher travel speeds, higher deposition rates and a larger bead. In the multiple arc process, the objective of the lead wire is to create the required penetration. The trail wire provides extra fill and the necessary bead profile. Additional arc wires (as many as six in one weld) will add even more deposition. **ARC**



Watch exclusive footage at [arcmagazine.pub](http://arcmagazine.pub) or in the *ARC Magazine*™ tablet edition (download it for free).

# Flashback

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## Dental Work

► **May 1940** — A welder from E.J. Albrecht Company repairs shovel sprocket teeth during a flood control project in Johnstown, Pennsylvania. Pads are laid longitudinally as shown to restore the teeth to their original dimensions. This particular sprocket was brought into the shop three times for reclamation, which prevented the need for costly replacement and extended the life of the sprocket by several years.

*Have any vintage (pre-1975) photos you'd like to share? Email them in jpeg format to [editor@arcmagazine.pub](mailto:editor@arcmagazine.pub) with a date the photo was taken (actual or approximate), a brief description (three or four sentences), and an email address where we can reach you for additional information.*

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Teachers come in many forms. We want to celebrate all of them. Help us tell the story of how gifted educators are changing the world of welding, one student at a time. If your submission looks like a good fit for an upcoming issue, we'll contact you for more information.

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