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CONTENTS


Photo by Brandon LaJoie

AARON KAUFMAN

Shifting into high gear

The custom builder steps out on his own.

12

THE NEED FOR SPEED

Race cars without engines

Bobsled designer Richard Laubenstein pushes for American gold.

22


Photo courtesy of Purple Films

ASK THE EXPERTS

The experts at Lincoln Electric answer your welding questions

10

BEGINNER TIPS & TRICKS

Post-weld clean up, brazing techniques and other tips

30

PROJECT SPOTLIGHT

Jimmy DiResta: A bench-top press brake for your workshop

34

ARCS & CULTURE

A Bountiful Harvest of Fabrication

38

FLASHBACK

November 1939: Frame Job

42

EDUCATOR SPOTLIGHT

Randy Calhoon: Citizen Welder

32

MASTER CLASS

The finer points of walking the cup

40

ARC

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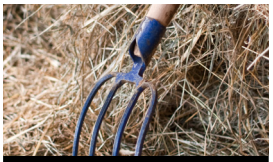
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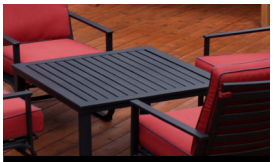
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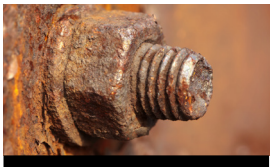
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LETTER FROM THE EDITOR

GAME CHANGERS

Welding has a long association with things that go. It's been a part of automotive manufacturing for nearly a century. It's been an integral process in the aerospace, shipbuilding and motorsports industries for almost as long. Simply put, the welding arc touches just about any craft that moves on land, sea or air.

In this issue we bring you stories of two very specialized designer/builders – one who makes custom truck parts for the road and another who makes competitive vehicles for the ice. Both are raising the bar by raising some basic questions.

Aaron Kaufman, the subject of our cover story, is no stranger to custom car and truck building. When we last visited him in the Summer 2015 issue, he was one half of Gas Monkey Garage (with business partner Richard Rawlings), a venture whose exploits were chronicled in the Discovery Channel series *Fast N' Loud*. He has since stepped out on his own and launched Arclight Fabrication, a restoration and custom parts business aimed at filling what Kaufman calls "a gaping hole in the marketplace."

Richard Laubenstein, the central figure in this issue's feature story, is all about speed – so much so that he doesn't even bother with wheels. He's the crew chief for U.S. Bobsled and Skeleton Federation. Armed with engineering expertise borrowed from NASCAR and BMW North America, he and his crew have been building Olympic-caliber bobsleds here in the U.S. for the past 25 years. In the early 1990s, the made-in-America approach was a bold departure from the then-standard practice of purchasing bobsleds from overseas manufacturers.

Both of these builders are people who stepped outside of their comfort zone on the chance that they might do something enduring and meaningful – not just for themselves, but as part of an effort to reach as broad an audience as possible and change the game, literally and figuratively.

At this writing, the premiere of Kaufman's new Discovery Channel series, *Shifting Gears*, is still a couple months away. Laubenstein, meanwhile, is in Pyeongchang, South Korea, where the U.S. Olympic bobsled team is competing in the 2020 winter games. Regardless of the eventual outcome of these two stories, both of these innovators are an inspiration to anyone associated with the art and business of welding, fabrication, building and making. They provide that inspiration by asking some simple questions: Is there a different way? Is there a better way? Is there something that can be done to get closer to the goal – and in so doing, raise the bar for everyone else?

As with any entrepreneurial or competitive venture, the questions don't always have definitive answers. But it doesn't matter, because the mere act of asking them usually leads us to a better place.

Warmer months are just around the corner, and with them come more opportunities to get into the shop and get busy on pet projects. When you get there, ask yourself a very simple but important question:

What are you doing to change the game?

— John C. Bruening, Editor-in-Chief
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What's the best and most effective way to adjust the tension on wire feed roller and spool on a MIG welder?

- Jose Rivera, Hernandez, Adjuntas Puerto Rico

Your adjustment should not be on the roller so much as the spool, where the primary tension control is the wingnut on the spool's axis. If the tension is too tight, the rollers won't be able to turn. If the tension is too slack, the spool will unwind and result in a bird's nest inside the cabinet. The ideal tension is somewhere in the middle – a little bit slack, but not too much. You want just enough tension that the wire will come off the spool as you weld, but not all the way around the spool. When the spool is running and you stop welding, the wire should stop short but should not be overly tight. There should be a little bit of slack in the length of wire between the spool and the roller, but no slack around the spool.

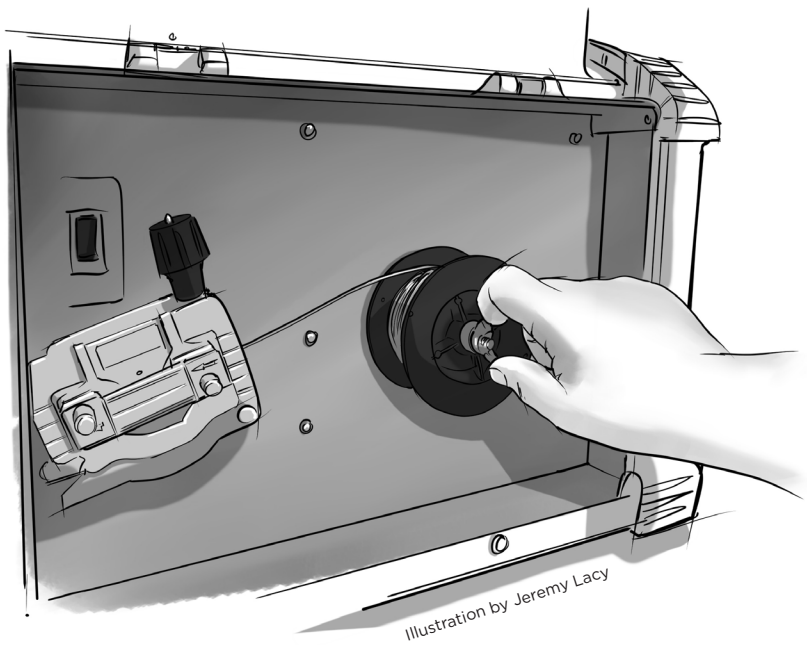

Illustration by Jeremy Lacy

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Most stick electrode manufacturers provide guidelines for the recommended operating current for each particular type and diameter of electrode. For example, the Lincoln Electric Filler Metals Selection Guide lists a typical current range of 90 to 160 amps for 1/8-inch Excalibur® 7018 MR®. How do I determine the optimum amperage to use for my particular application?

- Ken Sanders, St. Louis, Missouri

The manufacturer's typical recommended current range is a rough guideline that suggests the maximum and minimum current in which a particular electrode will satisfactorily operate. If the manufacturer suggests a current range of 90 to 160 amps, a good starting point for optimum operating characteristics would be the middle of the current range – 125 amps. Adjusting the current above 125 amps would work well and increase productivity on flat and horizontal welding of thicker plate, whereas turning the current down might be required to limit burn through on thinner materials or to control the puddle when welding in the vertical and overhead positions. Adjusting current above or below the manufacturer's recommendation is usually not suggested, because it could lead to poor operating characteristics of the electrode.

A tighter set of guidelines might be the current range that a welder is required to operate within a welding procedure specification (WPS). For example, a WPS for a 3-G/4-G qualification test on 3/8-inch plate using a 1/8-inch 7018 electrode might define a current range of 105 to 135 amps. The more conservative current range for this particular test could be determined by a number of factors, including plate thickness, joint configuration and the fact that the welding is being done in the vertical and overhead positions. A good starting point would be right in the middle of the range, at 120 amps, and to adjust up or down for desired operating characteristics. When working to a code, it is important to operate within the current range defined in the WPS.

Several factors determine the best current to operate an electrode for a particular job. For best results, start in the middle of the range and adjust accordingly.

If I want to fabricate a product such as a steel trailer, but make it out of aluminum instead – and assuming my welds are sound – what thickness of aluminum would it take to match the strength of steel, and what grade would you use (6061, 3003, etc.)?

- Dale Asher, Wichita, Kansas

The question is a little too complex for a simple answer like "use aluminum that is 50% thicker than steel," but we can provide some general guidance.

Aluminum is lighter than steel by volume. In fact, aluminum weighs 1/3 what the same volume of steel would. But steel is stronger than aluminum, and its Elastic Modulus is higher than that of aluminum. So you can't just replace steel with the same thickness and still have a safe design. In general, a good design in aluminum can save 40% over the same design in steel. This is done in two ways:

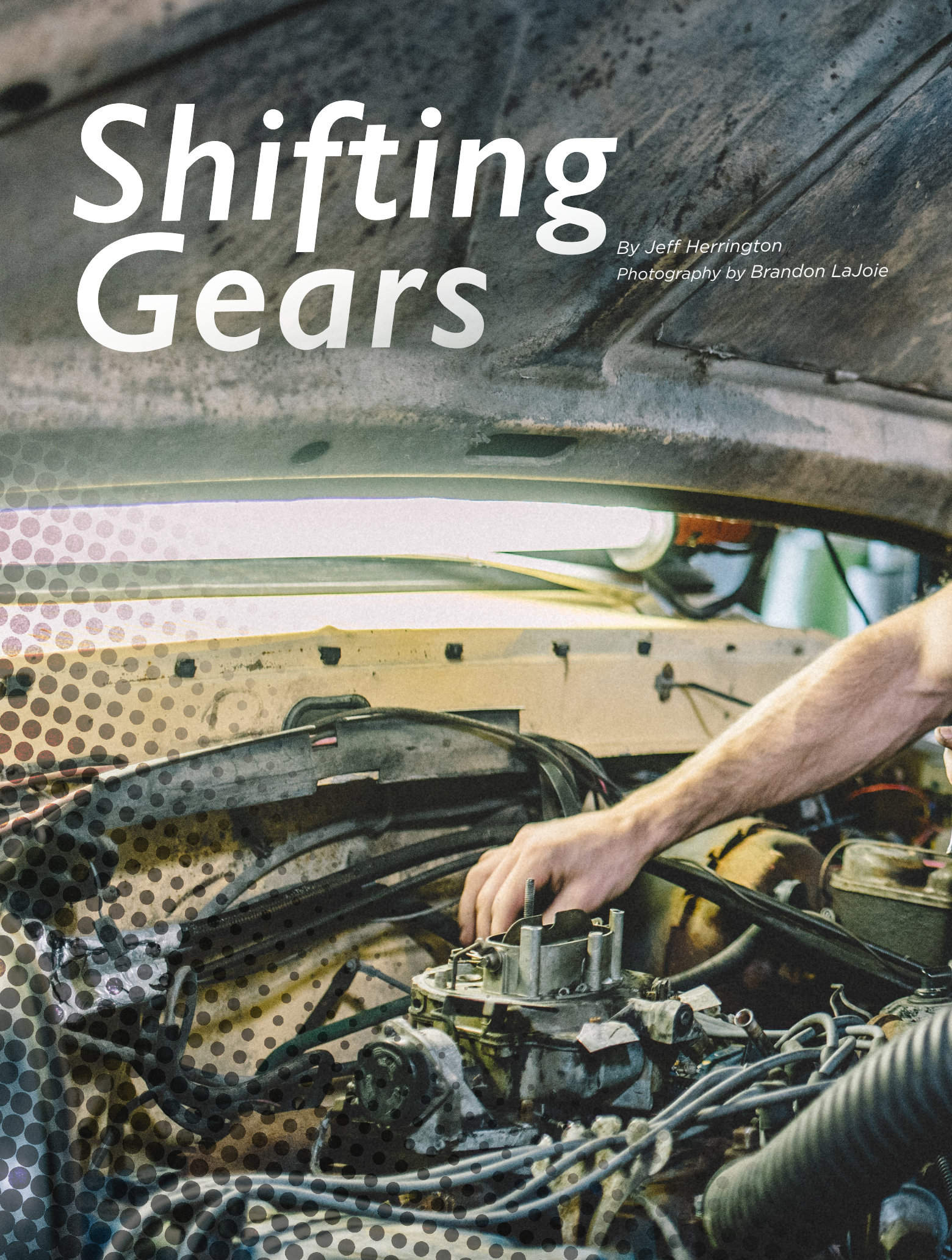
- Aluminum thickness should be 40% greater than material used in the corresponding steel design.
- For closed sections, such as square tubing, the aluminum section should be larger. For instance, if a 1-inch x 1-inch square tube was used for steel, the aluminum square tube should be 1-1/2-inch x 1-1/2-inch.

As far as which alloys you should use, the answer depends on what the specific part looks like. Closed sections such as squares or rounds should be made from extrusions. These will normally be 6061-T6 or 6063-T6. Parts that are sheets or plates should normally be made from one of the 5XXX structural plate alloys, such as 5052, 5454 or 5083.

The general guideline in this answer is just a starting point, and you should have a qualified engineer review the aluminum trailer design and load capacity to ensure it is adequate.

Shifting Gears

By Jeff Herrington
Photography by Brandon LaJoie



With a new custom-parts business and cable-TV show,

Aaron Kaufman

Shifts his career from **second gear into overdrive**

ARCLIGHT FABRICATION

These days, Aaron Kaufman is having lots of visions.

Maybe it's a vision of how to bend frame rails more efficiently. Or how to turn a bulky semi into a lean, mean, racing machine. Or even how to make a television episode more entertaining.

But Kaufman himself will be the first to admit the final product he pushes out the door (or across the airwaves) will likely be very different from the one he first envisioned.

"I usually have a clear idea upfront of what I want to produce," he says, "but as things progress, that idea often evolves. But that's always the challenge faced by those of us who are part businessperson, part artist. I've always fought being labeled an artist, but really, everything I'm doing now involves brush strokes, and I can't go against that, as much as the businessperson in me says at times that I should."

Good thing Kaufman is comfortable with change and flexibility. After spending almost two decades as the stalwart sidekick to Richard Rawlings of Gas Monkey Garage/*Fast N' Loud* fame, Kaufman is shifting gears to take top billing in a business that makes custom truck parts, as well as a new cable-TV series that explores the world of hot-rodding in a way no other show has.

Says Kaufman, "When I was at Gas Monkey Garage, the thought of running a business, and starring in a show was like looking at a postcard of some mountain out West. On the postcard, the mountain doesn't look that formidable, and you have a pretty good idea of just how you'd scale it. But I'm standing right next to that mountain now, and more aware of the mountain climb we have ahead and the different approach we should take to reach the top.

"To be honest, it's much more pressure than I thought it would be."

It's a mid-December day in Dallas. The sky is a stunning blue, and the temperature is hovering somewhere in the 70s. But inside the former putty factory housing Arclight Fabrication, Christmas carols are playing on the internal sound system, infusing an already-jovial workspace with full-out holiday cheer. Given Kaufman's television history, one might expect his new business venture to reflect a pace that's very fast n' very loud.

But it's not. Quite the opposite, in fact. A few cars and trucks in various stages of disassembly sit neatly parked throughout the Arclight workspace, as if placed there by careful valets. Employees cluster around a restoration project over there, or a CNC mill over here, calmly discussing how to boost the wow factor of whatever it is they're working on. A window separating the workshop floor from the office area sports a production schedule neatly written in colored pens; out front, recently painted stripes indicate exactly where visitors should park.

Its surface appearance may be all calm and order, but at its core, Arclight Fabrication is the epitome of the entrepreneurial start-up that's scrambling to capture the hearts and pocketbooks of what Kaufman calls "a gaping hole in the marketplace."

"I restored a lot of cars at Gas Monkey Garage, but I am essentially a Ford guy and a truck guy," he confides. "I've watched the parts market for C10 pickups become saturated, but it's still difficult to find parts for Ford F100-series trucks, especially those built between 1957 and 1979.

"Manufacturing may not be as sexy as hot-rodding, but I've always been enamored with it," he says. "Some see this change I've made as a big gamble. I see it as a big opportunity."

The business will begin by manufacturing a pro-touring chassis line. But in the operation's ongoing commitment to shifting gears whenever necessary, Kaufman notes that Arclight might be offering a very different menu of parts to a very different

customer base six months from now.

"I've learned that when you have a talented team of people who've worked together for a while, and that team is 'on,' they are unstoppable," he says. "I've assembled a really great team here, some of whom I worked with at Gas Monkey Garage, but we're still trying to figure out the exact flow."

The thing is, Kaufman's traveled down this entrepreneurial road before. He left Gas Monkey Garage at least once to start up his own venture, only to eventually return to the fold. So, one could easily think he'd be tentative about another attempt to fly solo.

Instead, he's emboldened.

"I've known a lot of incredibly capable people who had zero confidence in their capabilities, probably because they were afraid to make a mistake," he says. "For some reason, I've always lacked that fear of failure. I'm amazed at how good we can become at something if we just do it. In fact, to me, success is often a by-product of failure.

"I may also be doing this because I'd hate for the time I spent with Richard to have been nothing more than a good tale. I need to feel I'm putting all that experience to good use. Otherwise, I'm doing a disservice to it."

His confidence is buoyed by an industry that has undergone seismic shifts since he joined Gas Monkey Garage 17 years ago. For example, the tools used by smaller, independent garages like Arclight Fabrication have become much more affordable in recent years, he says. And thanks to the Internet, the knowledge one needs to redesign a vehicle – and the tools one needs to execute that design – are much more accessible.

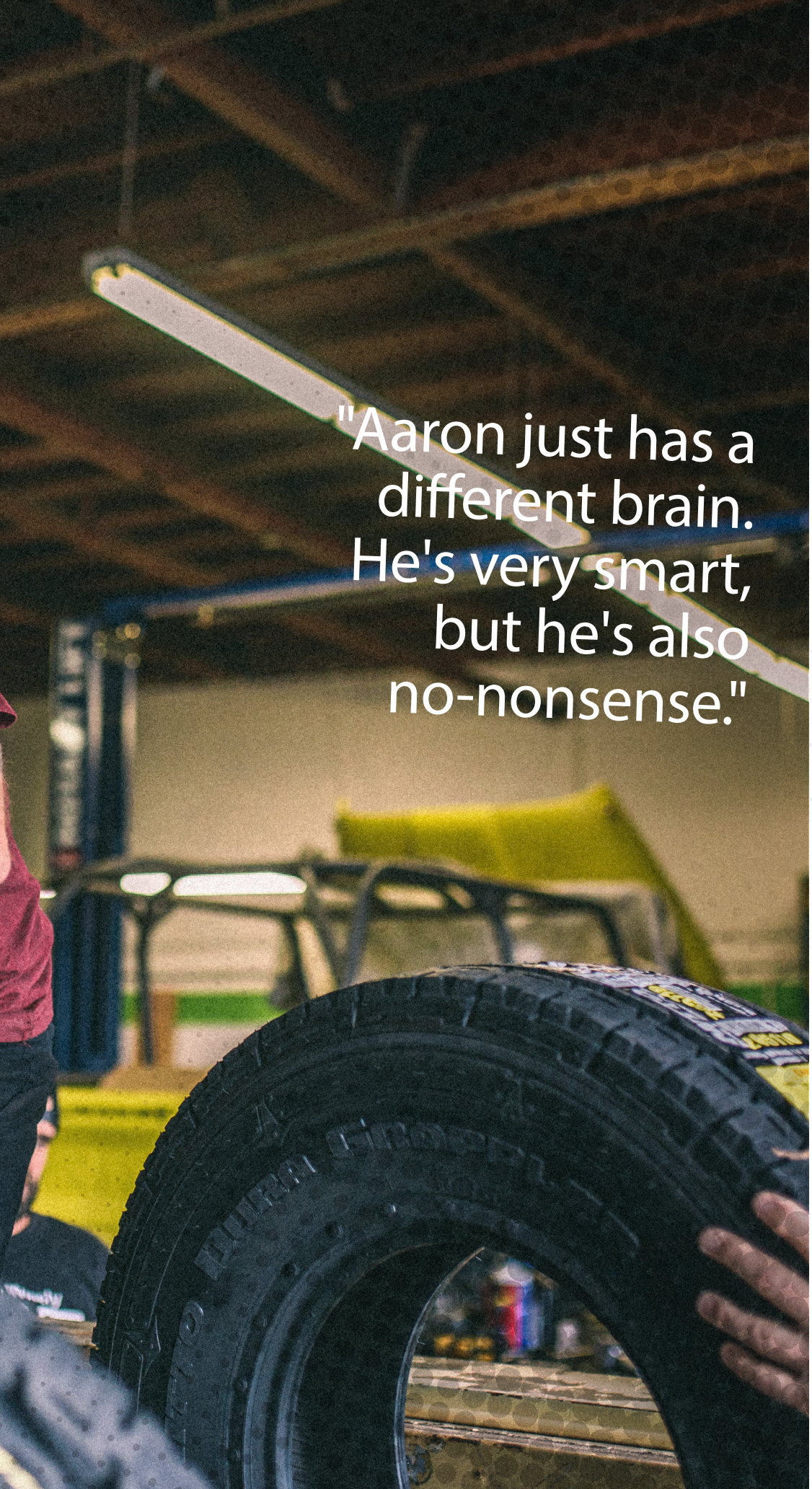
"I wouldn't say we're at the spear tip of parts manufacturing here," Kaufman acknowledges. "But I do know many of the tools and techniques we're using only became available to shops like ours about five years ago. As a result, the quality of what's getting created today is closer than ever to what manufacturers hope it will be when they begin."

SHIFTING GEARS

Television producers believe Kaufman's star quality, and the quality he infuses into each vehicle he restores, will draw viewers to *Shifting Gears*, his new show debuting this spring on Discovery.

"Aaron just has a different brain," says John Paul, one of the show's producers. "He's very smart, but he's also no-nonsense. If his guys have worked for hours on something while he's away, and he doesn't like it, he'll let them know in no uncertain terms. That makes him fun to watch."

In fact, fun with cars is the premise of *Shifting Gears*, Kaufman says. It will convey the same love for the magical transformation of a vehicle that *Fast N' Loud* has. But



its pace will be different, its focus will be different, and it will explore several aspects of automobile lore the other show does not.

For example, how a vehicle gets purchased will receive nowhere near as much air time as what happens to the vehicle after it's been transformed. The show will also shine a well-deserved spotlight on the firms supplying the parts that go into the builds – companies like MagnaFlow (which makes exhaust systems), Currie Enterprises (a California provider of parts for on- and off-road vehicles) and Bass Kustom, located in Dallas.

And although Kaufman's business revolves around the niche category of Ford trucks, *Shifting Gears* will highlight several hot-rodding subcultures.

"For the first season, we're filming 12 episodes, with three episodes devoted to each build," he explains. "One show focuses on our redesign of an International Harvester Scout, which we hope to race at King of the Hammers in California. Another will involve shortening and lowering a semi that we hope to take to the open road race in Big Bend, and a third will show us taking a Datsun 510 and converting it into an S13 coupe.

"Arclight Fabrication is my main endeavor these days," he emphasizes. "But I really enjoy doing TV. And most of the filming is happening inside our shop, so it's an amount of advertising for the business – good or bad – that I could never afford to purchase."

GREAT EXPECTATIONS

Not that Kaufman tends toward over-the-top self-promotion. Stumbling upon Arclight Fabrication during a random drive-around is near impossible, given it's tucked inside a nondescript warehouse with no exterior signage in a light-industrial district that's seen better days. Once the most dilapidated building on the block, the renovated structure now resembles your friendly neighborhood doctor's office, complete with a landscaped bed filled with rocks and cacti, as well as that recently striped parking lot.

Kaufman hopes that lot will soon be filled with visitors eager for a retail experience planned for just inside the building's front door. The emporium will feature pocket knives crafted by local steelsmiths, haircuts courtesy of an on-site barber, and t-shirts and caps bearing the Arclight logo.

Kaufman insists, however, that he plans to gauge the success of this latest shift in gears not by how many t-shirts he sells, but by how lasting an impact he makes on the industry he's been committed to his entire adult life.

"On one hand, I'll consider this venture successful when we start getting emails and phone calls from people asking when they can get some part from us, when we are actually moving products out the door," he says. "In fact, we're already hearing that the prices of F-100 trucks have increased since we started operations in September.

"But a more satisfying milestone of success for me would be knowing I made some meaningful impact on some entire genre of pickup trucks. I was riding motorcycles in Wisconsin recently with this guy who asked me why I was doing this. I thought about that and realized it's because I want to leave some legacy to this industry, impart some style upon it that people can touch for years to come."

He adds: "Given all the illnesses we could cure, and all the technologies we could invent, that may seem pretty trivial. But fixing up pick-up trucks is what makes me happy, and it makes a lot of other people happy, too. So, I say, 'Why not?'" ARC

" Fixing up pickup trucks is what makes me happy, and it makes a lot of other people happy, too. So I say, 'Why not?' "


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Photo courtesy of Purple Films

Richard Laubenstein is proud to help U.S. Olympic bobsled athletes compete on the world stage. His team's high-speed "race cars without engines" are built by some of the brightest auto-racing minds in America. They come together in the quest for American gold.

THE NEED FOR SPEED

By Kate Nicolosi

Richard Laubenstein

has visited more resorts in the past six months than many people dream of in a lifetime. Take a peek at his travel itinerary and you'll see he's stayed in the most exclusive mountain cities of the world: St. Moritz, Switzerland; Igls, Austria; Winterberg, Germany; Whistler, Canada; and Park City, Utah. Next stop: Pyeongchang, South Korea.

Whatever the location, Laubenstein barely has time to enjoy the view. He's got important work to do. "We are focusing 100 percent on bobsled," says the crew chief for the U.S. Bobsled and Skeleton Federation. His mission: To design and maintain the fastest, most aerodynamic bobsleds for America's elite athletes, including the U.S. Olympic Team, competing around the world.

"I've been traveling and dealing with time zone changes for 35 years," he says. It wasn't always for winter sports. Before embracing the bobsled, Laubenstein spent 22 years with Penske Racing, working as a fabricator at IROC and IndyCar®, then became Crew Chief at Racing Experience, managing 54 race cars and 25 mechanics. Today his goal endures: "To achieve greatness through racing. Every weekend you want to win."

Bobsled satisfies Laubestein's penchant for speed. Just like

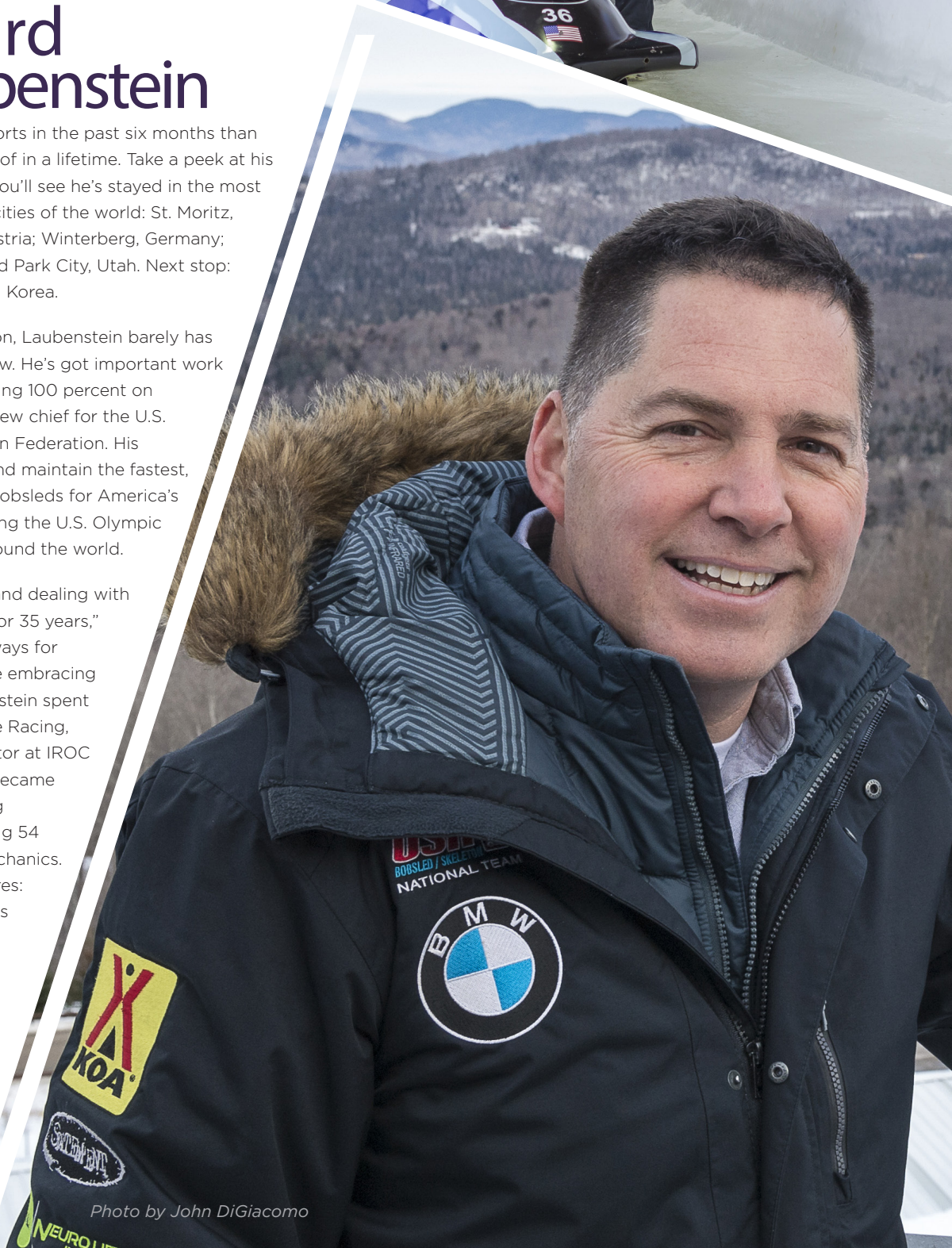


Photo by John DiGiacomo

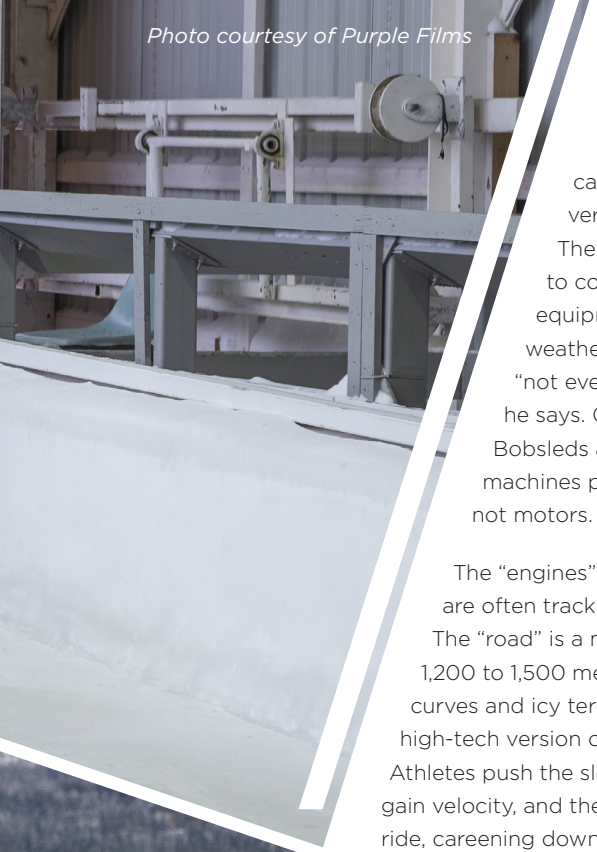


Photo courtesy of Purple Films

car racing, bobsled is "a very, very specialized sport." There are so many variables to consider: athletes, equipment, speed, tracks, weather conditions. However, "not everything correlates," he says. One major difference: Bobsleds are high performance machines powered by people, not motors.

The "engines" are the athletes, who are often track and field competitors. The "road" is a mountain track about 1,200 to 1,500 meters long with sharp curves and icy terrain. A bobsled is like a high-tech version of your childhood sleigh. Athletes push the sled in a sprinting start to gain velocity, and then jump in and enjoy the ride, careening down icy tracks at speeds exceeding 100 mph. One bad bump or turn can be disastrous. Similarly, one head raised too high could cause drag that slows you down by a few hundredths of a second, the difference between a trip to the podium and going home empty-handed.

There are three major strategies to being fast on the track, says Brian Shimer, bobsled Olympian and head coach of the men's U.S. bobsled team. First, bobsledding is "a gravity sport," so the push at the start is critical. Next, the pilot needs "years of experience and lots of seat time," he says. "One day of training is about two minutes. We don't get a lot of time." That's because a competition is typically a four-heat format over two days of racing with two heats on each day. "It's not like NASCAR® where you can train and do 500 laps and dial in your car. It takes a number of years for a pilot to be really good," Shimer says. Finally, making advances in equipment and technology are essential "to get you on the podium."

Laubenstein is blazing the trail on the technology front. He joined U.S. Bobsled and Skeleton Federation just before the Sochi Olympics in 2014. With a degree in automotive technology and business, he also has hands-on motor sports welding experience that easily translates to the bobsled.

USABS Federation Crew Chief Richard Laubenstein travels all around the world, but he doesn't spend much time enjoying the view: "We are focusing 100 percent on bobsled."

Laubenstein's bobsled crew is the only one that, as a matter of standard procedure, shows up at international competitions with a welder.

Photo by John DiGiacomo

Laubenstein – who hails from Kutztown, Pennsylvania – grew up watching his father and uncle take on various metal fabrication projects. “A large part of that was installing custom hitches on vehicles to tow trailers,” he says. “I recall wanting to install a hitch on my tricycle. It might not be the first thing I welded, but it’s the one I remember.”

In the progression from tricycle to race cars to carbon fiber bobsleds, Laubenstein developed and honed his skills every day to a point in his career where he now orchestrates a far-flung team of like-minded people who understand speed and racing.

Bobsled:NASCARonice

Laubenstein coordinates more than 30 experts to make one bobsled. The U.S. Team owns 20. Many of these collaborators hail from “Race City, USA” the Mooresville, North Carolina, hub of auto racing.

One of the U.S. bobsled team’s first partners helped change the face of the sport. Decades ago, the U.S., like many countries, was purchasing bobsleds overseas, effectively buying up other countries’ seconds. But in the early 1990s, Bob Cuneo of Chassis Dynamics – a colleague and mentor to Laubenstein – partnered with former NASCAR driver Geoff Bodine to build a bobsled from scratch in the United States. This was the beginning of Bo-Dyn Bobsled.

Cuneo, who fabricated the American-made sleds as part of the Bo-Dyn venture, initially “knew absolutely nothing about the sport.” He and Bodine and rest of the crew started with “a clean sheet of paper” and got to work.

It was a rocky start fueled by passion and patriotism. After a few years, Bo-Dyn’s ingenuity paid off, delivering top-notch machines that helped the U.S. win more Olympic medals, including gold in the four-man event at the winter games in Vancouver in 2010.

Laubenstein takes lessons from the past and looks to the future. Enter his latest partner, BMW North America. In a secret formula that harnesses aerodynamics, carbon fiber material and weight distribution, BMW North American built a medal-winning two-man bobsled for the Sochi games in 2014. They will also have sleds at the games in South Korea.

Jim “Cheech” Garde built cars for racing greats like Ralph Earnhardt and was enlisted by Laubenstein to work on the BMW sleds, among others. Garde, who recently put finishing touches on a four-man sled at the Olympic Training Center in Lake Placid, New York, says the process of building and finishing sleds requires input from all parties – athletes, coaches, engineers and fabricators.

“Fitting the athletes into the sled and the way they get into the sled” is always a part of the process, says Garde, who adjusts components after feedback from the athletes. “You can’t disturb the sled when you get in it. You have to be in correct position in aerodynamics.”

“It’s not just a high-tech piece of equipment like a Formula One car,” says Cuneo. “It’s all about the athlete. The driver’s got to push too – he’s part of the motor. I always tell the chiropractors and the training staff: ‘Make sure you tune up those motors for tomorrow.’”

Araceofslimmargins

Within a minute-long race, conditions are always a little bit different. “Some tracks are flatter, some are steeper and some athletes are a little bit better at one versus the other,” Laubenstein says. “We are constantly trying little teeny tweaks.”

Those tweaks can be made to a variety of components, including the frame, the cowling, push-bars, steering system, brake and runners. Fashioned out of a regulation stainless steel alloy made exclusively for the International Bobsled and Skeleton Federation, runners are “vital,” says Laubenstein. These “tires” of the sled are typically only 6 mm wide, but he enhances the size to increase speed.

“The larger the radius, the easier it glides,” which also results in less control, says Garde. “The nice narrow runners feel good, but don’t go as fast. Just like in most racing, if it’s comfortable, you’re not going fast.”

After Laubenstien buys the material, partners create the drawings and do the machine work to "smooth and shape" the runners depending on the sled, athletes and conditions.

"It's a big gain that we are always trying to chase," says Laubenstein, who owns 40 sets of runners that range between $6,000 and $10,000 a set. Each bobsled is unique, so it's difficult to buy hardware on the fly. "We carry as many spare parts as we can," says Laubenstein.

Laubenstein ships a 14-foot-long crate of tools and equipment wherever he travels. He says his is the only crew that, as a matter of standard procedure, shows up at international competitions with a welder. They even have a machine rated for the power supply in most European countries, which differs from the United States "We carry what we call our 'European welder,'" says Laubenstein. "A few years ago, some things were spec'd out wrong, and we were doing everything [on-site] from welding to carbon fiber repair."

"Richard has taken it to the next level in terms of getting partners involved and the continued advancement in technology," says Shimer. "Thirty years ago, when I was an athlete, we worked on our own sleds. We didn't have a sled technician. We carried a tool box around with a couple of wrenches and a big hammer. That was about it. Today it's way more involved."

Still, the resources in amateur sports aren't as slick as that of NASCAR, says mechanic Garde. "You can't bring everything and you are limited on what the containers hold. You may need a piece of metal so you are looking at a dumpster to see if there's a piece of steel you can cut off. Your inner MacGyver comes out on the road with bobsleds."

Going for gold

Laubenstein has established partnerships that give the United States an edge. Bobsled is gaining momentum as fans and sponsors take notice.

"He has bridged the gap – and he's gotten a lot of people involved," says Shimer. "It's always a challenge to keep up with nations such as Germany that put millions of dollars into their technology program. We rely on the private sector to dig deep and help out Team USA. Athletes are grateful for it. We are grateful for it. Our athletes keep battling, fighting until the end. [With the Olympic team announced] now they can really come together as a unit and focus on winning medals."

Ultimately, Laubenstein is doing specialized but rewarding work. "Helping a U.S. athlete compete on the biggest stage – it doesn't get bigger or better than that," he says. "Some people have a goal to go to the Olympics and others have a goal to win a medal." Laubenstein wants both. "Our goal is to win medals." ARC

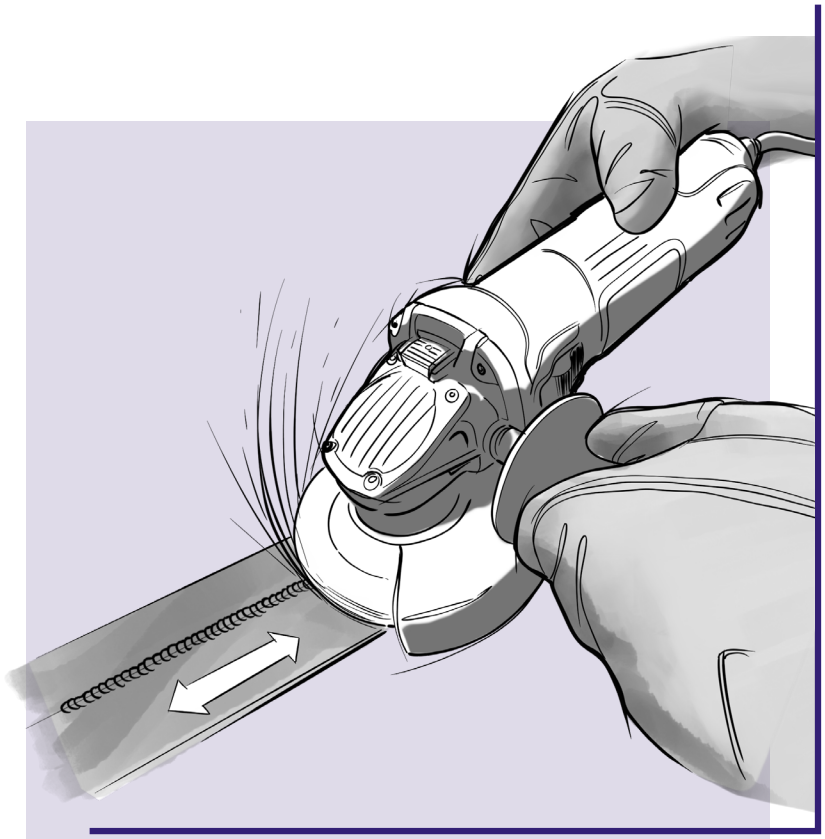
Photo by John DiGiacomo

Photo courtesy of Purple Films

"Some people have a goal to go to the Olympics and others have a goal to win a medal," says Laubenstein. "Our goal is to win medals."

BEGINNER TIPS & TRICKS

Make It Easier to Weld Your Workpiece.



Illustrations by Jeremy Lacy

POST-WELD CLEANUP

– THOMAS SISK, PITTSBURGH, PENNSYLVANIA

Chip off the slag with a welding hammer and use a 36-grit grinding wheel to knock the beads down to the surrounding metal. To ensure a flat, flush surface, move the grinder along the length of the weld, not across it.

JOINING METAL BY BRAZING

– RICHARD SGRILLO, LAKELAND, FLORIDA

Brazing galvanized sheet metal can be accomplished using a MIG welder with bronze wire and argon. It works great for sealing up the corners of a box, and it flows right into the zinc for a nice, neat fillet.

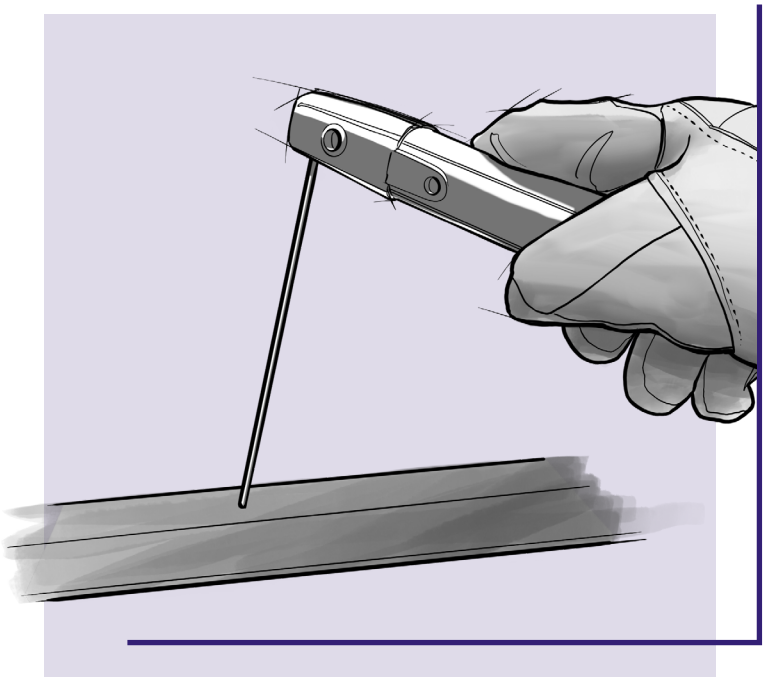
The use of adequate ventilation and an approved respirator is necessary to avoid overexposure to zinc — which can cause metal fume fever — from galvanized metal being welded.

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** 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®.



USE ARC LENGTH AND ELECTRODE ANGLE TO YOUR ADVANTAGE

– MICHAEL PAUL, BRENTWOOD, TENNESSEE

The arc length and angle of the electrode are important in producing quality welds. Excessive arc length can produce excessive weld spatter and arc blow, while insufficient arc length can cause the electrode to sputter or stick. Arc length can be used to control the heat input in the weld area. A shorter arc length will reduce heat input and a longer arc length will raise the heat input in the weld area. The angle of the electrode has similar effects on the weld area. Too much angle will increase heat input within the weld area that may cause spatter and arc blow. Too little angle lowers the heat input and can cause the electrode to sputter or stick.

DON'T HOLD BACK ON THE PREPARATION

– TONY HORTON, LONG BEACH, CALIFORNIA

For a great weld every time, no matter where or when, preparation is critical. The key to a clean, sound weld is to make sure your welding surface is as clean as possible. If there are any contaminants or other metal coating/protection on your weld surface, use a compound made for cleaning weld surfaces or grind the surface. Get right down to the bare metal to ensure you have a clean, bare surface to start making great-looking welds.

Be sure to wear the appropriate personal protective equipment, such as gloves and eye protection, when grinding.

ADD MORE LIFE TO THE LEAD WIRE

– STEVE ARLIN, LIMA, OHIO

To protect your lead wire at the stinger, mark the wire on your whip line. Then wrap six to eight layers of electrical tape 2 inches on either side of the mark. You'll wear out the tape instead of the wire's insulation. This will add life to the whip and save money.

RANDY CALHOON

CITIZEN WELDER

By John C. Bruening

Randy Calhoon wants to do more than just teach students how to be good welders. He wants to teach them how to be conscientious, productive members of their community.

Calhoon teaches basic through advanced level welding – stick, MIG and TIG – to somewhere between 50 and 60 students every semester at Cheyenne Central High School in Cheyenne, Wyoming. It's the latest chapter in a 45-year career that started with some high school welding classes of his own in the late 1960s, then segued into a union apprenticeship and subsequent work on intercontinental ballistic missiles for Boeing Aerospace in the early 1970s.

He left Boeing in 1975 to continue his formal education at a local community college while maintaining his own welding, fabrication and blacksmithing business on the side. Along the way he took several teaching gigs in Wyoming – first at Laramie County Community College, then at WyoTech in Laramie, and later at Gillette College's Technical Education Center in Gillette.

Regardless of where he's taught over the years, Calhoon has always considered education to be a two-way process.

"It has always been the student who leads me and teaches me," he says. "What they lack is what determines my focus. I focus on what they need to improve. In the end, I want my students to be what I call citizen welders. I want fabricators who are committed to craftsmanship and also involved with their community."

Calhoon promotes that involvement not just in the classroom, but in an annual community festival called Cheyenne Frontier Days. He enlists a handful of his students every year to assist him at the summer event and give presentations about blacksmithing and the benefits of a career in welding, metal fabrication and related trades.

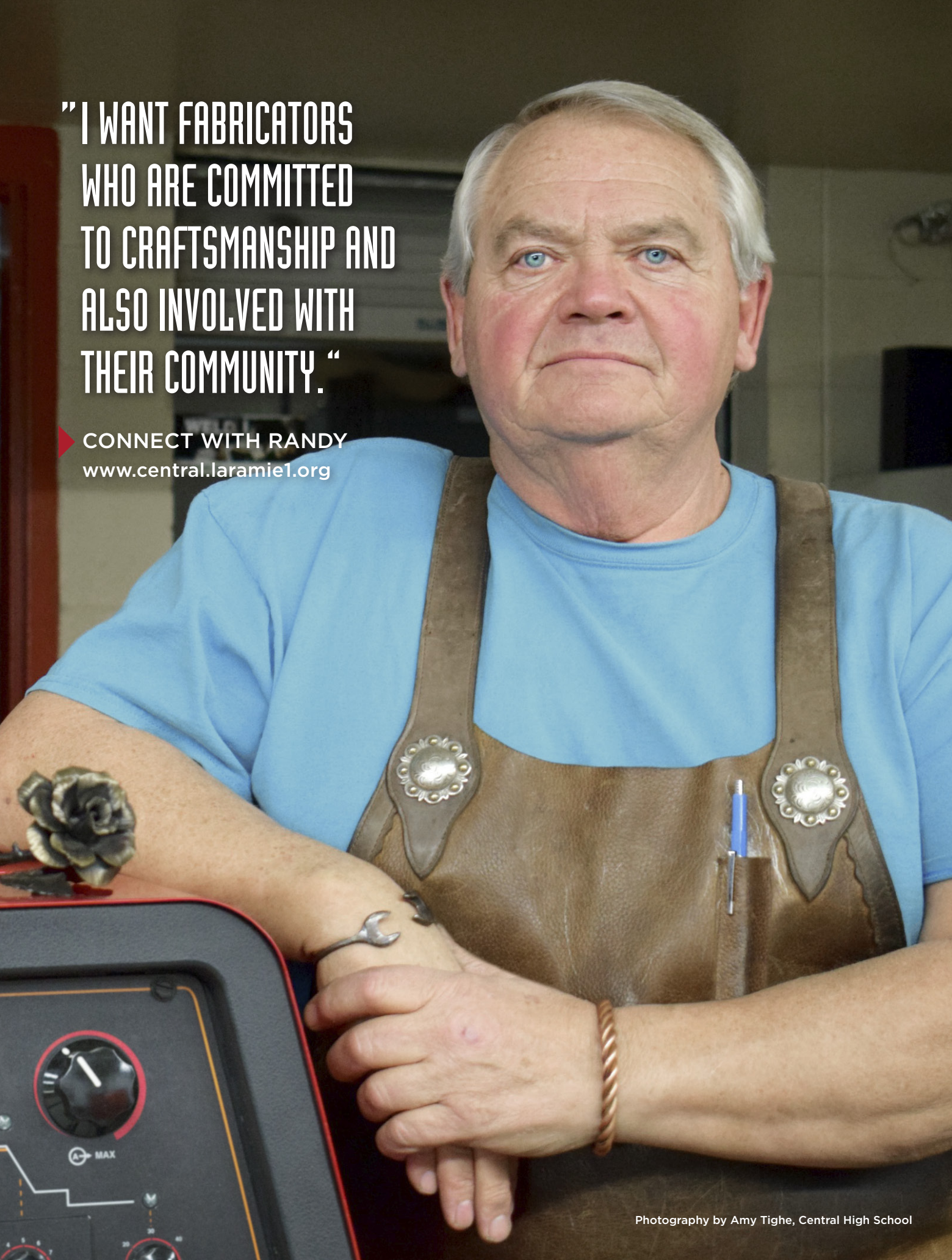
"The students do it strictly on a volunteer basis," he explains. "I give them two days' worth of basic blacksmithing training, and then they demonstrate with me at Frontier Days. They talk to people about the need for welders and craftsmen and the like. I put them out in the community, because if they're going to be good welders, if they're going to maybe run a business someday, they have to be recognized in the community in a positive way."

Mathew Wright, who is currently finishing his junior year at Cheyenne Central, was one of Calhoon's volunteers.

"It was a little stressful," Wright admits, "because I don't always like being up in front of a crowd – and Mr. Calhoon usually draws a fairly big crowd. But it was fun. We'd demonstrate a technique, and then bring the piece out after it cooled down to show the crowd."

He adds: "In some classes, you sit at a desk and learn most of the material from a book. But he takes us out of that environment and puts us in real-world situations. It's a challenge, but it's fun."

Calhoon believes that taking students like Wright out of their comfort zone is an effective teaching strategy. "Life gives you the test first, and the lesson comes out of that test," he says. "In school, it happens the other way around. You get a lesson, and then you take the test. Sometimes that doesn't work. So I put them in the water and let hem flounder a little bit. Then I pull them back out and say, 'Okay, now you probably have some questions.' That has always been an effective technique – putting them in a position where they have to ask questions. That's when the lesson starts." ARC


"I WANT FABRICATORS WHO ARE COMMITTED TO CRAFTSMANSHIP AND ALSO INVOLVED WITH THEIR COMMUNITY."
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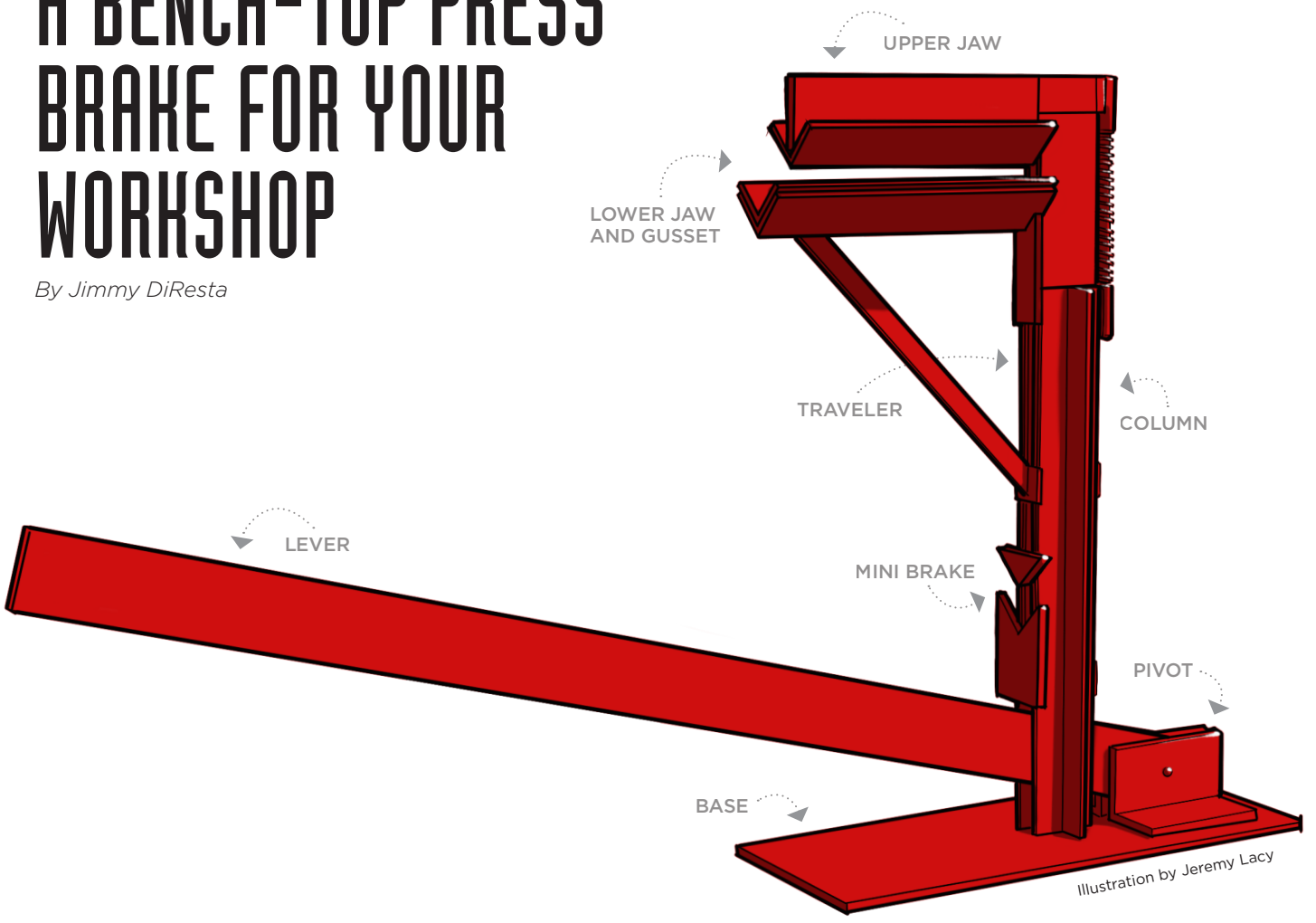
Photography by Amy Tighe, Central High School

A BENCH-TOP PRESS BRAKE FOR YOUR WORKSHOP

By Jimmy DiResta



A press brake allows fabricators to bend sheet metal to a desired angle. It can be a very valuable tool in your workshop. But you don't have to go out and purchase a press brake that takes up a lot of space in your shop to take advantage of its benefits.

In this project, craftsman and maker Jimmy DiResta builds a press brake out of scrap metal from around his shop that can be the perfect small-footprint addition to your shop.

Watch exclusive footage at arcmagazine.pub

© Jimmy DiResta

MATERIALS

1½ inch by 1/4 inch angle iron
1½ inch by 1/8 inch angle iron
3/8-inch mild steel plate
1½ inch by 1/8 inch mild steel flat stock
1½ inch by 3/16 inch mild steel flat stock
3/8-inch round stock
1½ inch by 1/4 inch flat stock
2 inch by 3/8 inch flat stock

WELDING/CUTTING EQUIPMENT AND TOOLS

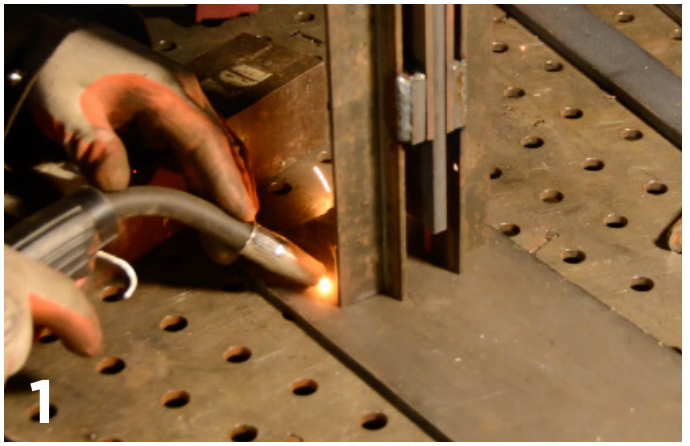
Lincoln Electric POWER MIG® 210 MP
Bandsaw with metal-cutting blade
Angle grinder
Cutoff wheel
Flat grinding disc
36-grit sanding disc
Vice grips
Drill
Speed Square
Clamps
Hammer

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. Use an approved respirator if exposure to welding fume cannot be controlled, or if welding outside and natural air movement is not sufficient to keep welding fume out of your breathing zone.

REMEMBER:

Press brakes have pinch points that exert significant forces when used. Always keep your hands away from the jaw area when using the brake.



Imagery © Jimmy DiResta

Step 1: Column and Base

Using two lengths of 1 inch by 1/8 inch angle iron of the same length (approximately 18 inches), weld a series of 3/8-inch spacers to what will be the inner faces of each column half. Using a 2-foot length of 3/8-inch bar stock as a spacer, clamp the two faces together and weld the angle iron at 90 degrees to a base cut from 3/8-inch plate. This will create the connected column and base, with the space between the angle iron assemblies acting as a channel for the brake's traveler. Using more 3/8-inch stock, weld a series of backing plates to the column.

Step 2: Lever Assembly

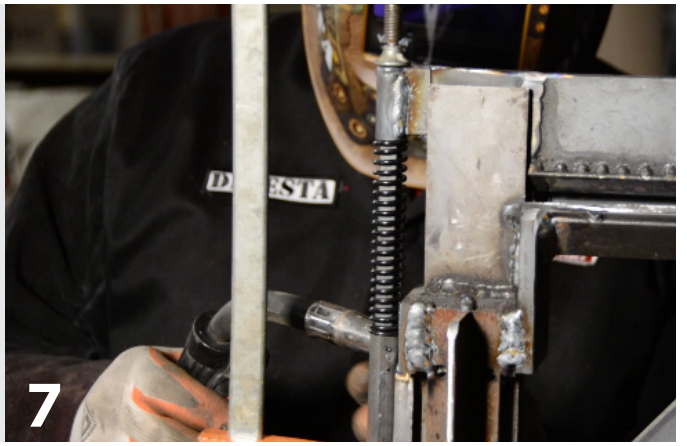
Cut two 4-inch lengths of 2½-inch angle iron and drill a centered 3/8-inch hole into the corresponding faces. These will act as the pivot for the lever. Using your lever (3/8 inch by 3 foot piece of bar stock) as a spacer, weld the angle pieces to your base, just behind the column. Using your predrilled holes as a guide, and keeping your lever off of the base by about 1/4 of an inch, mark the pivot hole on your lever, then drill a 3/8-inch hole through. The quarter-inch clearance helps create the necessary clearance to move the traveler. Create the pivot point using a piece of 3/8-inch round stock welded to each of the angle uprights. Knock off the end corners of the lever to create more clearance.

Step 3: Creating the Traveler

Cut two square pieces of 2 inch by 3/8 inch bar stock. To ensure perfect alignment when drilling, tack weld these pieces together, and then drill 3/8-inch holes into opposite corners. These holes will serve as the pivot points between the lever and traveler. Using the spacer stock from step one, knock off the corners of the end that will be pinned to the pivot point and drill a centered hole that corresponds with the pivot hole in this assembly. Once you're satisfied with the fit, weld in a piece of 3/8-inch round stock to complete the traveler's pivot assembly.

Step 4: Upper Jaw

Weld a piece of 1/2-inch angle iron to a piece of 1/2-inch bar stock of the same length so that the "point" of the angle iron is 90 degrees to the bar stock. This point becomes the blade of the upper jaw. Join this blade to the top of the traveler at a 90-degree angle.



Step 5: Lower Jaw

Cut a 90-degree angle into the end of a piece of 3/8-inch bar stock and weld to the column just below where the upper jaw will come to rest in the down position. Using this as a base, create the lower jaw from two pieces of angle iron. Weld into place at 90 degrees from the column. To ensure that this piece, which will carry the brunt of the downforce, does not deflect during use, weld a gusset made of bar stock that connects the outer lip of the lower jaw to the column assembly.

Step 6: Mini Jaw

For making bends in smaller stock, this addition to your benchtop brake will come in handy. Cut a 90-degree "V" from a piece of 3/8-inch or 1/2-inch bar stock and save the cutoff. With the lever of the brake in the down position, weld the female part of the V to the inner side of the column, about 1/3 up the length of the base. Place the male portion of the V in the mating surface and weld that into place.

Step 7: Spring Assembly

To make sure that the brake returns to the upright position after each bend, a spring mechanism needs to be installed. Weld a piece of tubing to the rear of the upper jaw assembly. Insert a length of bar stock into the tube and weld it at the top. Slide a length of spring over the bar stock and using another piece of tubing, clamp the spring into the closed position. Weld that piece of tubing to the lower jaw.

Step 8: Mounting Holes and Finish

Since you will be applying a good deal of downforce when bending metal, it's advisable to drill mounting holes into the base plate to accept screws or bolts to secure it to the bench. To prevent rust, you may also want to consider applying a few coats of finish.

A detailed drawing and cut list for this project can be downloaded at **arcmagazine.pub.**

A BOUNTIFUL HARVEST OF FABRICATION

Fifth-generation farmer Justin Chambers knows it's easier – and much less expensive – to build machinery as opposed to buying something new. That's where a lifetime of sharpening fabrication skills comes in handy.

On his family's farm in Albany, Oregon, Chambers has fabricated several essential pieces of equipment, all of which serve critical roles in keeping operations running efficiently, especially during the planting and harvest seasons when there is no time to waste.

Chambers' fabrication skills, which he learned from watching his father and grandfather, are not limited to farm work. In his spare time, he is transforming an old dairy barn into a space that doubles as a workshop and party room. Here, Chambers is able to display his creative side, working on intricate designs that will adorn the structure. The party room's debut event was the wedding reception of Chambers' sister and her husband, and he hopes more gatherings will follow.

In any project, Chambers enjoys working with metal because of its strength. "I enjoy being able to tack a workpiece in place, examine it to make sure it's correct, and then weld," he says. "Your item is instantly tied together." ARC

Photography courtesy of Rainfall Projects

Master Class

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

A PATH TO WALK THE CUP

By Karl Hoes

Walking the cup is a common welding technique that smoothly and evenly advances the torch around a pipe or tube while maintaining a consistent arc length.

Walking the cup is a welding technique often employed in the process and power piping industries (though it is appropriate for other applications) as a means to smoothly advance the torch around the pipe or tube while maintaining a consistent arc length. The technique involves resting the insulated ceramic nozzle, commonly referred to as the cup, against the workpiece and manipulating the torch as a way to advance it forward.

The cup-walking technique provides several benefits compared with the freehand technique, including reduced operator fatigue and better torch control. Safety is a factor as well. The pipe can get extremely hot, meaning fabricators cannot rest their hands on the material.

There are many different variables that determine the correct fit up and procedure to use when welding pipe. For example, when welding a 6G 6-inch Schedule 80 carbon steel pipe in the field, an engine-driven welder may be used with a valved torch. There are times when gas tungsten arc welding (GTAW) is specified to weld the entire joint, while other times just the root and hot pass are performed with GTAW followed by other more productive processes for the fill and cap passes.

The coupons are cleaned and prepared to a specified bevel and edge preparation. The pipes are fitted and tacked in four places with a gap just slightly less than 1/8 inch and placed in the 6G position.

The touch start method is typically used with a No. 26 torch, and the shielding gas is manually turned on and off with a valve on the torch.

One way to deposit the root pass is to use the lay wire technique with a No. 5 or No. 6 cup and 1/8-inch alloyed tungsten electrode. The electrode is extended beyond the cup far enough to allow the torch to lean back slightly while maintaining a close arc length.

For the lay wire technique, the filler wire, which is typically the same size as the root opening, is added at the front of the tack and left tightly in the joint as welding progresses through other tacks.

The cup rests on both bevels, also referred to as 2-point contact, and it's manipulated slightly by rotating the wrist from side to side. The arc is started on the bevel and moved to the bottom tack. For the lay wire technique, the filler wire is added at the front of the tack and left tightly in the joint as welding progresses through other tacks to assure complete penetration.

The inside root pass profile should be no less than flat to slightly convex, and should not exceed 1/8-inch maximum reinforcement.

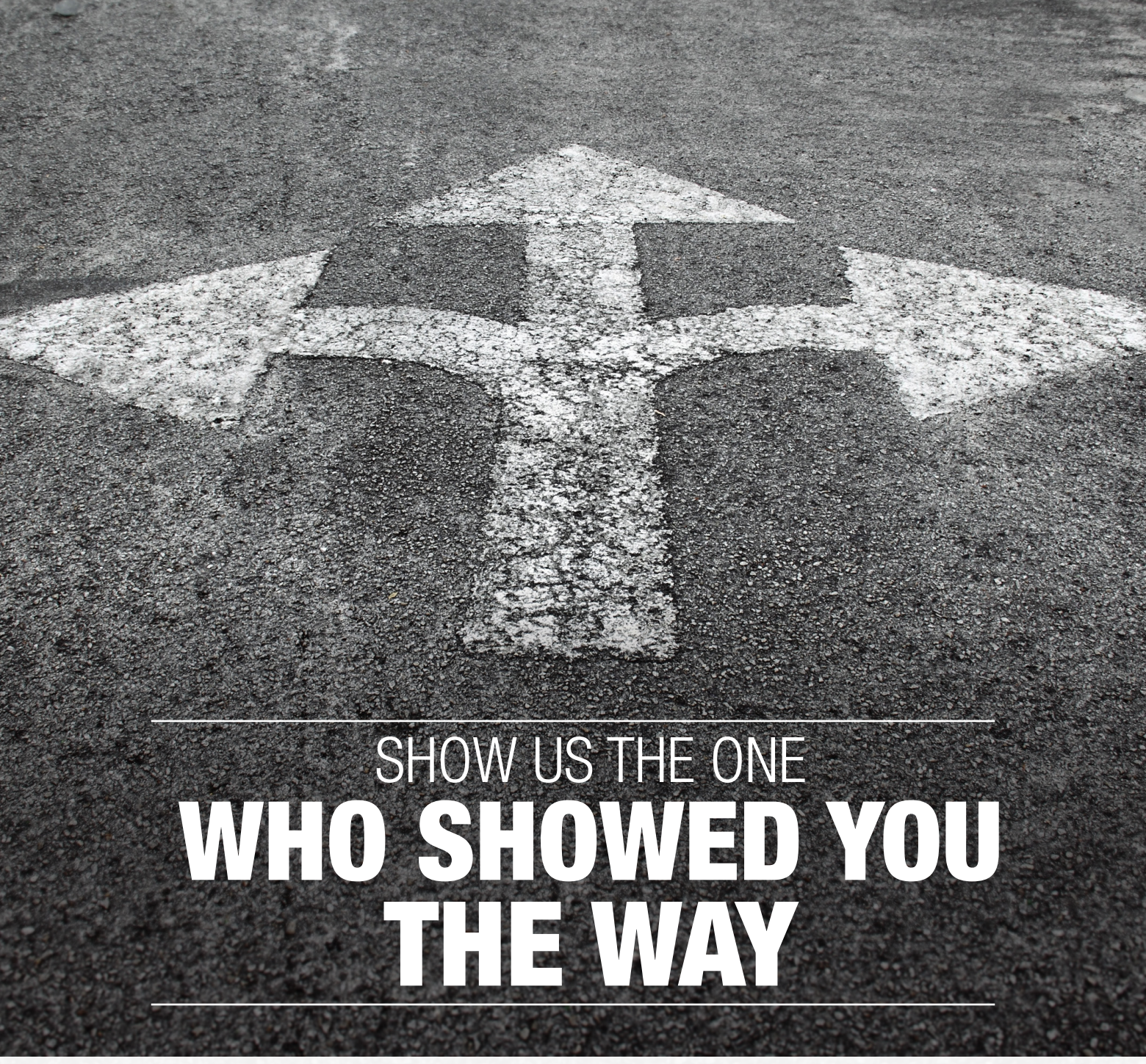
When welding, the arc should be started on the bevel and brought into the joint. When the weld is complete it should be brought back onto the bevel to prevent potential issues caused by the crater. This technique should also be used when tacking the pipe together to assures that no silicon island is left in the root pass. The crater and silicon island left on the bevel are re-melted during subsequent passes.

The hot and fill passes are typically put in with higher current and larger cup sizes to allow the 2-point contact with the bevel but without touching the cup on the previous weld. As the bevels are filled up, a larger cup and 1-point contact are often used by rolling the cup over the previous weld. Likewise, the 1-point rolling technique is used on thinner-walled pipe where there is no bevel. ARC

Frame Job

Have any vintage (pre-1975) photos you'd like to share? Email them in jpeg format to 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.

November 1939 — Welders at Florence Stove Co. in Kankakee, Illinois, repair a broken cast iron press frame. The frame was damaged when the hammer came down while the die was improperly aligned. The repairs took 68 hours and required 100 pounds of electrode, but they ultimately saved the company from having to spend $25,000 (more than $440,000 in 2018 dollars) on a new press. **ARC**



SHOW US THE ONE

WHO SHOWED YOU THE WAY

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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