

**Q: One of our resistance welding machine operators recently lost part of his finger when it was crushed between the electrodes of the machine. How can we protect our operators from similar injuries in the future?**

**A:** Forging forces ranging from several hundred to several thousand pounds are required to properly resistance weld metal together, so resistance spot and projection welding machines can be dangerous if care is not taken to protect the operator.

For example, a welding machine operating at 600 lb of forging force with an electrode contact area of ¼ in. will produce more than 12,000 lb of force per square inch on a finger or anything else caught between them.

Having witnessed an operator crush his finger while on a factory tour years ago, I certainly share your desire to avoid this unfortunate situation in the future.

While not necessarily simple, the safest way to ensure operator safety on a resistance welding machine is to tool the machine to hold and clamp the part, which avoids the need for an operator to posi-

tion and hold the part during the process — Fig. 1.

In a welding machine with proper tooling and guards, the operator manually loads the parts and then completely clears out of the welding/pinch point area before the machine closes the tips.

That being said, it is not always possible to accomplish. Following are outlined some other ideas that can help ensure operator safety.

You did not specify whether the machine involved in the accident was a rocker arm-type spot welding machine or a vertical action press-type machine, so enhancing the safety of both is addressed.

### Rocker Arm Spot Welding Machine

These machines are typically used to weld sheet metal parts that are held with both hands while the operator manipulates the part in the throat of the machine to access all the weld locations.

Initiation of the machine should be with a shrouded foot switch, and a pinch point warning sign should be prominently displayed — Fig. 2. In addition, the oper-

ator should be instructed verbally and in writing to keep his hands away from the tips.

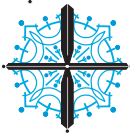
Although using both hands to hold the part usually ensures that the operator's fingers are not in the pinch point area, management can augment safety by selecting the right machine for the job and setting it up properly.

A simple way to reduce the potential for a spot welding machine pinch point injury is to position the machine's electrode tips so close together (typically about a ¼-in. gap) that a finger cannot get between the tips prior to the weld stroke.

To overcome clearance problems caused by such a short working stroke, an optional feature for the welding machine called an adjustable and retractable stroke air cylinder can make it much easier to load bulkier parts, such as those with flanges or lips, into the welding machine's throat prior to welding.

When using retraction, the operator typically steps on a separate shrouded foot switch to activate the adjustable retraction stroke, also called "high lift," which gives the operator extra clearance to load the part in the throat prior to reverting to a minimal stroke for welding.

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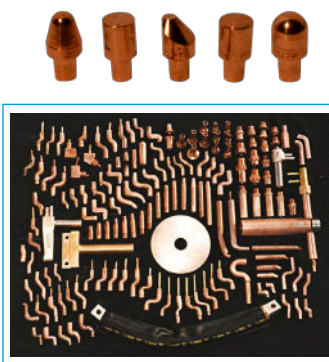


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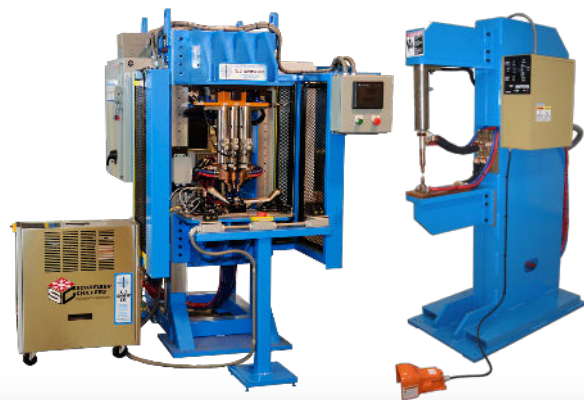
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However, if an operator is not properly trained in the operation of a retraction feature, or if it's not properly adjusted, additional pinch point dangers can result when the machine comes out of retraction.

OSHA requires guarding against pinch point injury to be passive. This means that there can be no way to defeat the protection system and that safety of the welding machine cannot be dependent upon operator adjustments. Since the gap between electrodes can vary depending on the setup, at present the only way to meet this OSHA requirement is by use of a system called "Soft Touch."

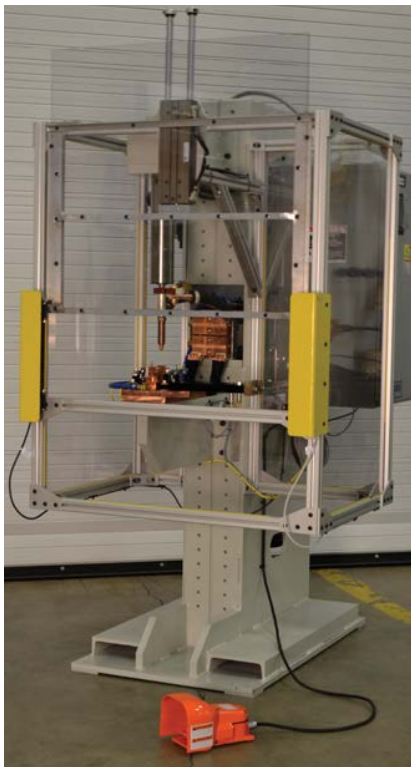


Fig. 1 — A growing trend is to completely guard the pinch point of a resistance welding machine. In addition to a physical enclosure, this vertical-action pedestal-type spot welding machine includes a light curtain to ensure that the operator's hands are outside the pinch point area after loading the assembly to be welded into a tooling nest. When the operator initiates the machine with a foot switch, a door automatically closes the opening in the enclosure and shields the operator from weld flash.

### Press-Type Resistance Welding Machines

A vertical-action press-type spot welding machine can be operated much like a



Fig. 2 — A — A rocker-arm spot welding machine with a prominently displayed pinch point warning sign; B — a close-up view of a warning sign.

rocker arm and initiation with a shrouded foot switch is generally acceptable if both hands are used to hold the part being welded — Fig. 3.

Again, using the Soft Touch system and/or reducing the gap between the tips

to ¼ in. are recommended, as are adjustable and retractable stroke welding machine cylinders to make loading and unloading easier.

Hand-loading projection welded nuts or weld studs exposes the operator to



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pinch point injury every time a part is welded, since the gap between electrodes must be greater than ¼ in. to clear the part. One solution is to place the nuts or studs on the part prior to placing the part between the electrodes. The part can then be supported by a table and the welding machine initiated by use of dual hand buttons installed with an anti-tie-down safety circuit. If this method is not practical, use of the Soft Touch system will provide the required protection.

Another highly recommended solution is to use an automated bowl feeder and placement mechanism to load the nuts or studs being welded.

Projection welding machines with tooling mounted to T-slotted platens in the throat of the machine are considered to be much like a sheet metal stamping press when it comes to ensuring safety, since the parts being welded are typically loaded by hand into a locating fixture directly under the ram in the pinch point.

Dual palm buttons connected to an anti-tie-down and anti-repeat circuit have long been the standard initiation means for projection welding machines, and optical-touch devices are rapidly replacing the old-style palm buttons that require physical force to depress.

Guarding of the welder's pinch point with wire mesh or Plexiglas is also more prevalent than ever, and light curtains in-

stalled on the opening ensure that the operator is completely outside the work area when the machine is initiated (see Fig. 1).

Zone scanners are also now available that sense if someone is inside the guarded area.

Using a robot to replace the operator and manipulate a fixtured part inside the throat of a rocker arm or press-type resistance welding machine is also a good way to enhance safety.

We applaud your desire to learn from this accident and to help protect your operators from similar injuries in the future. It is also encouraging to see that a growing number of companies are becoming proactive by adding protection systems to their spot welding machines before accidents occur.

As we've explained, there are numerous ways to enhance the safety of resistance welding machines, but proper operator training, especially of new hires or temporary workers, should be top priority. ♦



*Fig. 3 — Standard spot welding machines, both vertical action and rocker arm types, can be operated safely if an operator holds the parts with both hands outside the pinch point area. Safety can be enhanced by minimizing the opening between the tips and by a control feature called Soft Touch.*

*TOM SNOW is CEO of T. J. Snow Co., Chattanooga, Tenn., a resistance welding machine manufacturer and a member of the Resistance Welding Manufacturing Alliance (RWMA). Send your comments/questions to Tom at TomSnow@tjsnow.com, or to Tom Snow, c/o Welding Journal, 8669 NW 36th St., #130, Miami, FL 33166.*