ERGONOMIC SOLUTION UPLIFTING TO STEELWORKERS

Bending, twisting and lifting...a common recipe for injury. This practice was repeated over 1,000 times per 24 hours by the Brickers at Cascade Steel Rolling Mills, Inc. when relining a ladle. Despite repeated, proactive efforts from Cascade Steel and its employees to correct the ergonomic problem, the hazard proved elusive and difficult to correct. A team, assembled courtesy of an ergonomics grant, finally produced an innovative solution worthy of being dubbed the "Bricker's Lift."

Cascade Steel recycles scrap steel and turns it into a variety of steel products. Cascade Steel is a wholly-owned subsidiary of Schnitzer Steel, Inc. and obtains the majority of its scrap from its parent company. Cascade Steel's plant is located in McMinnville, OR and produces nearly 700,000 tons of finished product per year. These products include rebar, which is used in the construction of bridges, buildings and foundations, wire rod, used to make fencing, welding rod and hangars, fence post, rounds (bolts), angle iron, grape stakes and merchant bar products. Cascade Steel services customers throughout the Midwest and West Coast of the United States (including Hawaii) and exports to customers in Canada and Mexico.

The process of recycling scrap steel starts in the Melt Shop. Steel is loaded into the main furnace and electricity is used to turn it into a molten liquid. Every hour, 100 tons of steel is drained from the furnace into a large, refractory-lined cup, known as a ladle. The steel is then further processed and turned into a 6" by 6" by 30' pieces of new steel.

Ladles are subject to intense heat (up to 3,000 F.) and chemical energy. The refractory protecting the ladle's outer shell is in direct contact with the molten steel and is subject to wear. Subsequently, at least one ladle needs rebricking per week and this is the responsibility of the Bricking position at the mill.

Ladles are 10 feet high and nine feet in diameter. Over 1,300 bricks comprise the lining of the ladles with each brick weighing between 20-25 pounds, depending on type. Workers in the Bricker position have suffered injuries due to the repetitive motion, awkward postures, weight of the material and range of movement needed to line a ladle. There have been two disabling injuries, a shoulder injury requiring permanent light duty, a hernia, which required surgery, and numerous aches and pains associated with the task.

Cascade Steel is concerned about employee injuries and understands the effects not only in direct and indirect costs, but also in employee morale. Prior to the ergonomic grant project, attempts to eliminate the mechanisms of injury were unsuccessful. Brickers stacked consecutive pallets of bricks on top of emptied pallets in order to keep the bricks at a more favorable position. They also built a steel platform to raise themselves and the pallets of bricks higher for the latter half of the relining. An off-the-shelf scissor lift was bought and trialed, but proved to be more of a hindrance than a help. Medical appliances such as back braces, knee and elbow pads were provided. Despite these attempts, moving bricks still required stooping, kneeling and lifting over the head.

Research of available technology by Cascade Steel to solve this problem found no ready-made solution. Consequently, Cascade Steel applied for an ergonomic grant through the Worksite Redesign Program of the Oregon Occupational Safety and Health Administration in the Spring of 2000. The grant was awarded in August of 2000 thanks to the help from Mike Lulay, OR-OSHA. Upon receipt of the grant, Cascade Steel entered into agreement with Patrick Kraft from the Oregon Manufacturing Extension Partnership (OMEP) to aid in administering, facilitating and overseeing the project. A team consisting of engineers, production workers,

managers and health and safety professionals was assembled to address the issues and develop a solution. The challenges to overcome by the team were not insignificant:

- Employees were installing bricks in a range from their feet to over their head. A device needed to be developed to move the Brickers from 18-96 inches.
- Any platform that would be inserted needed to be wide enough to access the bricks and prevent falling hazards, yet not wide enough to disturb installed bricks.
- The feet of a platform needed to be placed to avoid ports in the bottom of the ladles and needed to be able to accommodate small irregularities in the levelness of the floor.
- The device had to be able to be moved by forklift and crane.
- Controls for the device needed to be durable and placed to prevent tripping.
- Pallets of bricks weigh 5,000 pounds each, any solution had to be rugged.
- All fittings used in the design had to be heavy duty because dust and debris is generated during the relining process.
- Power had to be either 120 volt or 480 volt.

The conceptual idea was a dual scissor lift platform with an indexing top. Essentially, the bottom lift would act as an elevating floor with the floor rotating as needed. On top of that floor would be a smaller scissor lift, positioned offset, that would hold the pallet of bricks. Basically the Bricker would stay stationary as the bricks were laid row by row.

The rotating floor and offset upper lift was eliminated in the first design meeting. Two Brickers usually line the ladle at the same time. They work on different rows as they go up and offsetting the lift would get in the way. Additionally, offsetting the upper lift added additional torque to the bottom scissor lift structure. Rotating the floor was eliminated not only because of the two Brickers concurrently working different rows at different speeds, but also to reduce the mechanical complexity of the lift. A non-rotating floor proved acceptable.

A triangular sub frame with footings was engineered to replace the traditional rectangular frame found on commercial units. This frame was designed to avoid ports in the bottom of the ladle and contained attachment points for lifting by crane. It was substantial enough to use with a forklift.

The design group brought in Lance Troutman of Material Handling Concepts, Inc. to offer ideas on commercial lifts that could be mated together. Lance felt that a double scissor lift would offer the range of motion and strength to work as the bottom lift. Working together, specifications were developed for the unit and sent out for bid.

The final design called for the bottom lift to be a dual scissor lift with the triangular sub frame. It was to have a 10,000 pound capacity and heavy-duty bushings and bearings. Range of the lift was 18 inches collapsed to 96 inches fully extended. Fixed to the top of the bottom lift was an eight foot in diameter, ¾" steel plate and the upper lift. The upper lift was to have a capacity of 6,000 pounds

Two sets of controls, operating both lifts, were mounted on the steel floor, adjacent to the upper lift. Provisions were made to have all control power within the confines of the lifts to avoid damage and eliminate tripping hazards. Attempts were also made to run the 480 volt, 3-phase power through the biggest port in the bottom of the ladle. The power connection could be accessed though a panel cut in the steel floor. Unfortunately, due to the location of the bottom lift motor and other considerations, power had to be run out the top of the ladle.

Cascade Steel took delivery of the lift in August 2001.

A successful project is defined by the end user actually liking, using and integrating the product into their work. The resulting lift, generated by the design group at Cascade Steel, is one of those successes. "The Brickers love it," says Melt Shop Superintendent Dave Wainwright. "All of them have come up to my office to comment on it," he said.

"I really like it," said Harold Krueger, Bricker at the mill, "I particularly like not having to use a ladder to get in and out of the ladle. "And," he added, "it sure makes lining a ladle much easier."

Cascade Steel felt that this ergonomic grant project was so successful that they applied for additional grants to meet needs in another part of the mill. But before it was approved, the grant program was cut by the legislature. This was despite a strong letter-writing campaign and lobbying effort by Cascade Steel and its parent company. "It's too bad this program was cut," said Sue Benoit, Health and Safety manager, "It has a direct, tangible effect on the workers."

Oregon OSHA's (OR-OSHA) Worksite Redesign Grant program provided up to $76,800 in grant monies for this project. This covered most of the costs to design, prototype, and install the system to its final configuration. It also included the pre and post ergonomic evaluation reports and documentation of the workstation so that others could benefit from the research. Cascade Steel Rolling Mills Inc. contributed the required 10% match, in the form of concept meetings, installation, testing, and reporting on the outcomes of the Bricker's Lift system. While the system was designed for their special needs, they believe it may be of interest to many companies with similar applications and issues.

All product designs developed through this program are public property. The design is complete, and will be available to anyone wishing to duplicate or further develop the welding manipulator system. A web based project archive is in the process of being constructed, that will provide details on this and many of the 35 to 40 grants being completed. It will be linked from the main Oregon OSHA website and will provide information such as project overviews, ergonomic reports on the projects, as well as design and vendor information so that anyone may research the results and adopt the technologies.

Information about developments and the status of this program can be obtained from Oregon OSHA (www.orosha.org).
Phone: 1-800-922-2689
http://www.cbs.state.or.us/osha/grants/worksiteredesign.htm

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