

- 2 Using hopper car door safety ratchet wrenches can keep doors from swinging and striking workers
- 3 Hand and foot injuries can be prevented by using safety car movers instead of ordinary pinch bars to spot cars by hand (Where a locomotive is available, it should, of course, be used)
- 4 By using warning targets, derails, and red lanterns at night, and by locking switches, workers can keep cars they are working on from being moved
- 5 Prohibiting the undermining of piles and avoiding overhangs can reduce the danger of cave-ins of loose material
- 6 Electric shock can be prevented by grounding portable belt conveyor loaders

Some foundries have eliminated double handling by having the raw materials put directly from the cars, storage piles, or bins into unit charging trays or boxes, which are taken to the point of use and dumped mechanically. Trays or boxes to be carried overhead must be properly trimmed

#### Ladles

Ladles for distributing molten metal or reservoir and mixing ladles, which are mounted on stationary supports or trucks or handled by overhead crane or monorail and which have a capacity of not more than 2000 pounds may be of the hand-shank type and should be provided with a manually operated safety lock (Fig 28-2). Shanks should be made from solid material, and shields should be installed on them

Ladles which have a capacity over 2000 pounds should be of the gear-operated type. Such ladles and those which are mechanically or electrically operated should be equipped with an automatic safety lock or brake to prevent overturning or uncontrolled sway

Suitable covers should be provided on portable ladles

The rim or lip on hand or bull ladles should be built up above the top of the metal shell with fire clay no more than  $\frac{1}{2}$  in. if the refractory ladle lining is less than  $1\frac{1}{2}$  in. thick at the rim. In any case, the maximum height of the rim or lip should be not greater than 1 in.

Ladles should be thoroughly dried out be-

fore being used. Local exhaust should be provided to control vapors or fumes produced during ladle drying. Some foundries control both vapors and excessive noise produced by gas torches used for drying by performing all operations in a ladle-drying shed located outside the foundry

Monorail ladles and trucks used to transport molten metal ladles should be equipped with warning devices (bells or sirens) to be used whenever molten metal is being transported

Trunnions and the devices used to attach them to flasks, buckets, ladles, and other equipment should be constructed with a factor of safety of at least 10. The diameter of the head on the outside end of the trunnion shaft should be not less than one and one-half times the diameter of the trunnion shaft. The inside corners where the trunnion shaft joins the base and the head should be filleted to prevent the sling or hook from riding the trunnion base or head

Inoculation or treatment of molten metal to desulfurize it or to change its composition or type, as in the making of an alloy or ductile iron, is done in the reservoir or in a pouring ladle. A hood can be made to cover this operation so that the workmen are effectively shielded from possible spatters of metal caused by the violence of the reaction. The resulting fumes are drawn off and exhausted through a stack. (Details for local exhaust removal of contaminants generated in this operation may be found in *Engineering Manual for Control of In-Plant Environment in Foundries*. American Foundrymen's Society)

#### Hoists and cranes

Hoists and cranes that handle molten metal require a preventive maintenance program, conducted by men trained and thoroughly familiar with the equipment. (This is in addition to observations and inspections made by supervisors and operators.) The degree to which the program should be carried out depends on both the equipment being used and the tonnage moved. The program should be geared to making sure the operation is safe, not to a minimum compliance with existing regulations

For example, a program for a 300-employee, ordinary gray iron foundry could require