MIFACE INVESTIGATION: 04MI074

SUBJECT: Millwright Dies When Struck by Uncontrolled, Flailing Crane Cable

SUMMARY

On Tuesday, June 22, 2004, at approximately 1:10 p.m., a 62-year-old millwright was fatally injured when the overhead crane he was attempting to troubleshoot malfunctioned during a lift. The crane had been used to lift a draw die weighing 42.5 tons to a height of between 15 and 25 feet above the plant floor (Figure 1). After the initial lift, the die setter found he was unable to raise or lower the load. This left the load suspended in the air. He called for crane repair. The decedent was one of two millwrights who responded. He removed the gearbox cover, exposing the drum gear and pinion gear. He indicated to an electrician who had joined him on the plant catwalk that he saw a piece of metal caught between the gears, and he thought he could pull it out with a pair of channel locks. As he was attempting to dislodge the metal piece from the gear by pulling on it with a pair of channel locks in his right hand and jogging the hoist motion switch with the remote control box in his left hand, a catastrophic failure occurred resulting in the unsupported load falling to the plant floor. The decedent was struck in the head and on his body by steel cables as they violently unspooled from the uncontrolled drum. Local police and fire personnel responded to the scene. He was pronounced dead at the site by the Medical Examiner.

Figure 1. Crane hoist

RECOMMENDATIONS

- When troubleshooting or making mechanical repairs on a crane, control all sources of energy. If the load is suspended, provide some means of support for the raised load to dissipate its potential energy.

Keywords: crane, potential energy, other

- Transport all loads as close to the floor as possible and ensure that there are no employees or obstructions in the path.

INTRODUCTION

On Tuesday, June 22, 2004, at approximately 1:10 p.m., a 62-year-old millwright was fatally injured when the overhead crane he was attempting to troubleshoot malfunctioned during a lift. On June 22, 2004, MIFACE investigators were informed of the fatality by the Michigan Occupational Safety and Health Act (MIOSHA) personnel who had received a report on their 24 hour-a-day hotline that a work-related serious injury had occurred. On December 7, 2005, the MIFACE researcher interviewed a representative of the company who was involved in the investigation of the fatality for the company. During the writing of this report, the medical examiner's report, photographs taken by the company photographer and plant safety personnel at the incident site, the police department report, and the MIOSHA file and citations were reviewed. The photos used in this report are courtesy of the MIOSHA investigating officer with permission from the company involved.

The plant in which the decedent worked was a stamping plant. It stamps parts for automobiles and trucks. It is one plant in a company that employed approximately 75,000 workers. The company was over 100 years old; the plant was 35 years old. The decedent was a millwright. He had been employed by the company and worked in this plant for 33 years.

The plant had a joint labor/management health and safety committee that met at least monthly. The plant had joint labor/management health and safety training programs including an established energy control and power lockout program. The decedent had had training (16 hours) and had received annual refresher training in energy control and power lockout. It is not known whether the decedent had received specific training in how to troubleshoot this particular piece of equipment although he had been working with it and others like it for many years.

The MIOSHA investigation resulted in one Serious violation with two parts being issued to the company: CONTROL OF HAZARDOUS ENERGY SOURCES, PART 85, RULE 1910.147(c)(4)(i) ADOPTED BY RULE 8502 - the power lock out procedure was not used while the crane was being serviced and the load was not on the ground nor secured when the crane was being serviced.

INVESTIGATION

On Tuesday, June 22, 2004, at approximately 1:10 p.m., a 62-year-old millwright was fatally injured when the hoist of the overhead crane he was attempting to troubleshoot malfunctioned during a lift. A die setter had used the 50-ton capacity model 1963 Whiting top running, double girder, center drive electric, overhead traveling crane to lift a three-piece die weighing approximately 42.5 tons (85,000 pounds) to a height of between

15 and 25 feet above the plant floor. The die setter called for crane repair when the crane hoist had stopped operating, leaving the load suspended in the air. The decedent and his partner responded to the call at approximately 11:45 a.m. The decedent climbed to the crane trolley while his partner remained at ground level spotting to keep people out of the way. He tested the controls, found the load would not move up or down and moved the crane to an aisle out of the way of other materials being moved in the plant. He believed the problem may have been electrical, so he descended to contact an electrician.

He and the electrician then climbed up to the crane. The decedent and the electrician observed the crane hoist drive shaft moving while the drum remained stationary. The electrician indicated that there was something wrong between the motor and the shaft. They also noticed smoke coming from the crane hoist secondary gear box. The decedent unbolted the gear box cover, and he and the electrician lifted the cover off the secondary gear box to expose the drum gear and the pinion gear. The decedent indicated to the electrician that he observed a piece of metal (a tooth from one of the gears) wedged in the gears, and that he would remove the piece of metal with a pair of channel locks. He attempted to dislodge the piece of metal by pulling on it with the channel locks he held in his right hand and jogging the hoist motion switch with the remote control box that he held in his left hand.

As he was attempting to dislodge the metal piece from the gear, a catastrophic failure occurred resulting in the suspended load falling to the plant floor. While the load was falling the wire rope drum cable was unreeling. The drum spun faster than the cable could unreel causing the cable to swing and jerk violently in the air near the trolley where the decedent was standing. The decedent was struck in the head and on his body by the flailing wire rope cables (Figure 2). These injuries were fatal. Fire personnel removed his body to an ambulance where it remained until the Medical Examiner arrived a short time later.

Figure 2. Wire rope cables.

An independent third-party crane inspection expert was contracted to examine the crane components. The inspection revealed that the pinion gear had failed and broken into three pieces (Figure 3). This resulted in the drive train uncoupling allowing the load to fall to the plant floor. Subsequent investigation and metallurgical tests suggested that the failed pinion gear had cracked during one event and fractured sometime later. The tests

also revealed a high probability that the pinion gear's inside diameter was machined outside its original specifications by 0.005 inches. This added stress may have contributed to the fatiguing of the gear once it was pressed onto the shaft. This defect would not be revealed during a visual inspection.

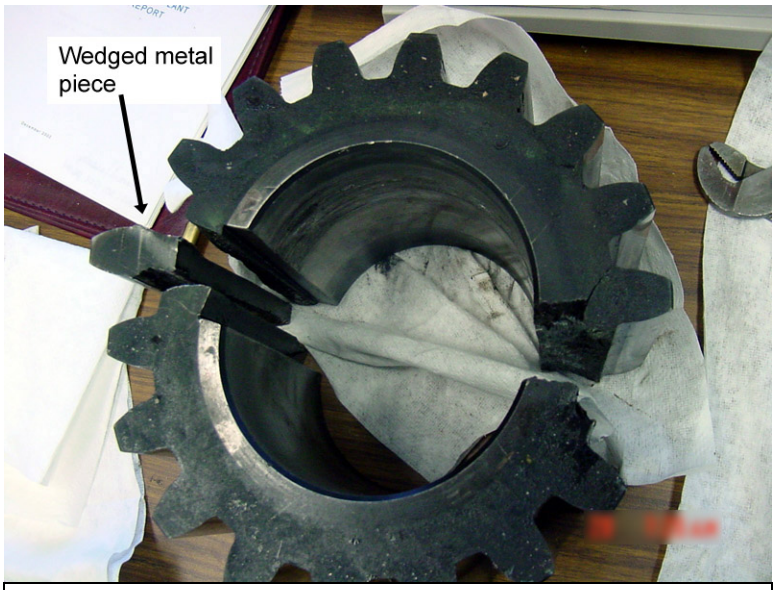

Figure 3. Broken pinion gear.

CAUSE OF DEATH

The cause of death as listed on the medical examiner's report was cranial cerebral injuries. Toxicology tests for drugs and alcohol were all negative.

ABATEMENT

The following short- and long-term actions were taken by the company:

All cranes in this plant and all similar cranes used by the company were inspected by an independent third-party crane expert. All cranes with pinion gears suspected of being cracked were taken out of service. Suspect pinion gears were sent to a laboratory for metallurgical analysis. Several pinion gears were found to have incorrect internal diameters. The information regarding the pinion gears on similar cranes was immediately sent to all other stamping plants in the company. It was also sent to the management of stamping plants in the same industry as this company. In this company all Whiting cranes built during that time period eventually had the pinion gear replaced.

A safety alert and single point lesson focused on troubleshooting cranes that fail to lift or lower while in use was sent to all facilities globally (see Reference 3).

The plant developed and implemented procedures to reduce the risk of carrying a suspended load by:

1. Carrying loads as low to the floor as possible.
2. Moving, if possible, to safe areas and placing the load over dies and adapter plates to minimize potential energy;
3. Barricading the area, and;
4. Conducting a pre-task job safety analysis prior to any troubleshooting.

Training for employees assigned to inspect the cranes was revised to include:

1. Troubleshooting safe practices;
2. Transporting the load; and
3. Preventive maintenance inspections

RECOMMENDATIONS/DISCUSSION

- When troubleshooting or making mechanical repairs on a crane, control all sources of energy. If the load is suspended, provide some means of support for the raised load to dissipate its potential energy.

Because of the mechanical problem, the load could not be lowered. The potential (stored) energy of the raised load was not controlled. It was allowed to become kinetic (motion) energy when the gears released. Had the load been supported before the attempt to free the hoist was made, the free fall would not have occurred.

- Transport all loads as close to the floor as possible and ensure that there are no employees or obstructions in the path.

It is not known why the load had been raised to a height of 15 to 25 feet. If raising the load to that height had not been necessary, it should have been carried closer to the floor. The crane had been moved to a location where it would not impact nor interfere with other operations before the troubleshooting began. A spotter had ensured there were no employees in the area.

REFERENCES

1. MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Labor and Economic Growth (DLEG) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Labor and Economic Growth, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

2. Accident Prevention Manual for Business & Industry, Engineering and Technology, 11th Edition, National Safety Council, Chicago, 1997.

10/3/06

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