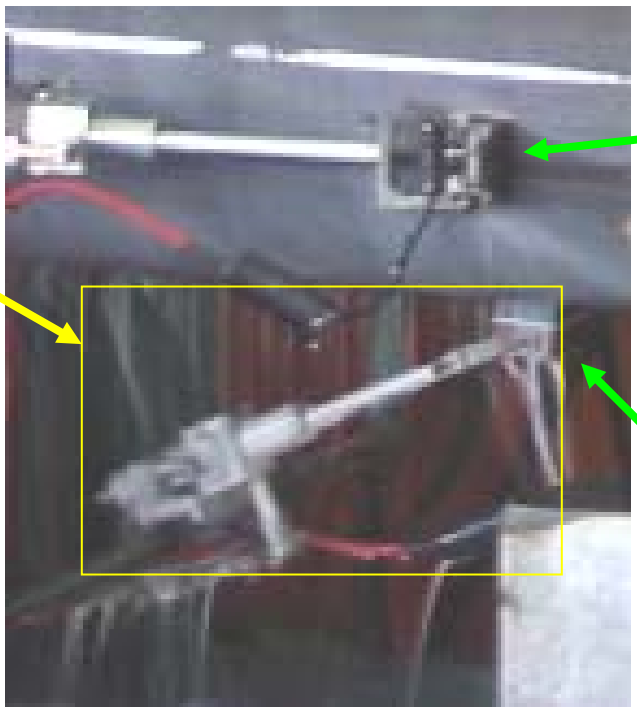
Western Instruments Inc.

Bleed-Off Grounding Shoes

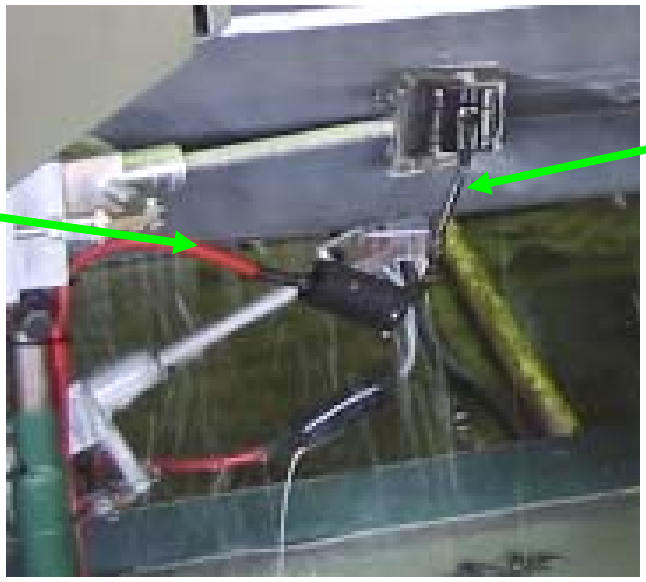
Bleed-Off Grounding Shoes provide a practical solution to Induced Current Erosion from Seam Annealers on pipe manufacturing mills

This phenomenon is related to Inductive Seam Heating of the weld area, typical on API Tube and Pipe Mills. A Pipe, placed in close proximity to a timed varying magnetic field will have currents induced as if the pipe is a one-turn secondary in a transformer. Such currents will seek a return path to their source, and tend to run from the Inductor, along the pipe, until it meets a suitable return path such as a Mill Stand, Support Role, or NDT Equipment. At this junction, arcs and sparks may form, eroding important parts or just radiating high levels of radio frequency noise, in a broad spectrum.



Prior to 1958, standard practice used a frequency of 10 kHz, so called Sub-critical Annealing, which was of *marginal* benefit at best. In approximately 1958 Magnethermic Corporation, of Youngstown Ohio, proposed moving to lower frequencies (1 kHz) for through heating to normalizing temperatures. Subsequently, one installation was made but it took about three years to become operational. Experimental work carried out independently, by Alex Palynchuk, reached a similar conclusion that it was pointless to continue using 10 kHz and so-called sub-critical annealing.

Later, using this information, testing was carried out at both Magnethermic and TOCCO and it became obvious that the highest useful frequency was 3 kHz and while 1 kHz was within the audible range, it was a better solution.



In the first successful installation, at Alberta Phoenix Tube & Pipe, using 960 Hz, with a capacity of 500kW, induced currents became obvious. After solving the initial inductor limitations, the mechanical equipment to support the inductors was judged to be unsuitable for use with 1 kHz, due to undesirable equipment heating. A totally new design of inductor was made and subsequently licensed by Magnethermic, and virtually all subsequent design approaches were based on the original Phoenix licenses.

The induced currents created a number of problems, the most serious being bearing damage, due to heating and electrical erosion. A number of approaches were tried, but the use of graphite brushes mitigated this condition. At that time no non-destructive testing was done and little, if any, electronics were used.

Again, under the direction of Alex Palynchuk at *Phoenix*, the first practical use of Mill and Conveyer-Line Ultrasonic Testing was developed, and the first Mill-Line installation was developed shortly after this Seam Normalizing System. These early UT Systems had to deal with EMI (Electromagnetic interference) to make on-line ultrasonic testing feasible, which included High Frequency Airborne Interference as well as Induced Currents.

Induced currents must be dealt with in this age of Microprocessors and sensitive electronics. Based on this historic and current experience Western Instruments now provides 'Bleed Off Grounding Shoes', as the location and extent of such currents varies widely within each mill. Installation must be individually tailored, and are based on Induced Current Surveys. The entire grounding system from Transformer to Mill Base must be understood and viewed as a complete, low impedance, circuit.

Western Instruments 'Bleed Off Grounding Shoes' are modular and can be located as required based on the on-site Survey results. In summary, the benefits of using 'Bleed Off Grounding Shoes' are:

- Protection of mill equipment such as rolls and bearings.
- Reduced EMI to improve reliability of Microprocessors, solid-state electronics, radios, etc.
- Reducing Arc damage and Arc Burns on pipe.