



HEATH & SHERWOOD

TUYÈRE PYROMETER

WITH **SMART CYLINDER**

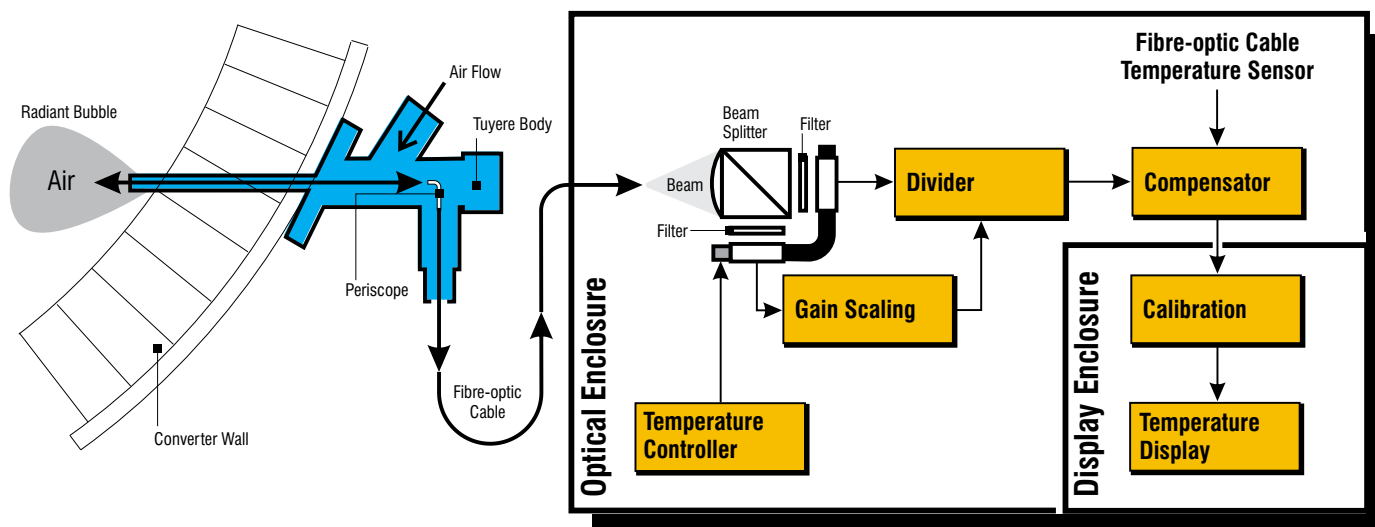
OPERATING IN
COPPER AND NICKEL SMELTERS
AROUND THE WORLD

Heath & Sherwood
The Legend Continues

DESCRIPTION

Temperature measurement is based on a combination of fibre-optics and two-wavelength pyrometry. Visible and near infra-red radiation emitted from the molten matte at the end of a tuyere is collected by a periscope device located at the air inlet end of the tuyere.

It is then conveyed through a fibre-optic bundle to a specially developed two-wavelength pyrometer housed in a protective enclosure. The pyrometer provides an indication of bath temperature.



The Effects of Iron Content in the Molten Bath

Smelting reactions take place over the surface of the Radiant Bubble at the end of the Tuyere Pyrometer. Measurement actually depends on the temperature of this reacting surface and not the melt's bulk temperature.

Provided the temperature difference between the reacting surface and the melt remains constant, thermocouple calibration will automatically adjust the Tuyere Pyrometer to read the true melt temperature.

When the iron content in the melt drops below 1%, the smelting reaction in the vessel changes from the matte mode (oxidation of FeS) to the copper mode (oxidation of Cu₂S) and less heat is generated at the Radiant Bubble. Consequently, the Pyrometer temperature reading falls even if melt-bulk temperature remains constant. This allows operators to predict and detect the transition from matte making to copper making in the vessel. A simple formula is then used for on-line calibration adjustment to determine the actual melt temperature.

The Effects of Oxygen Enrichment

Higher oxygen enrichment increases the intensity of the reactions at the bubble surface. Consequently, increasing oxygen enrichment will cause the Tuyere Pyrometer reading to rise, even if the melt temperature remains constant.

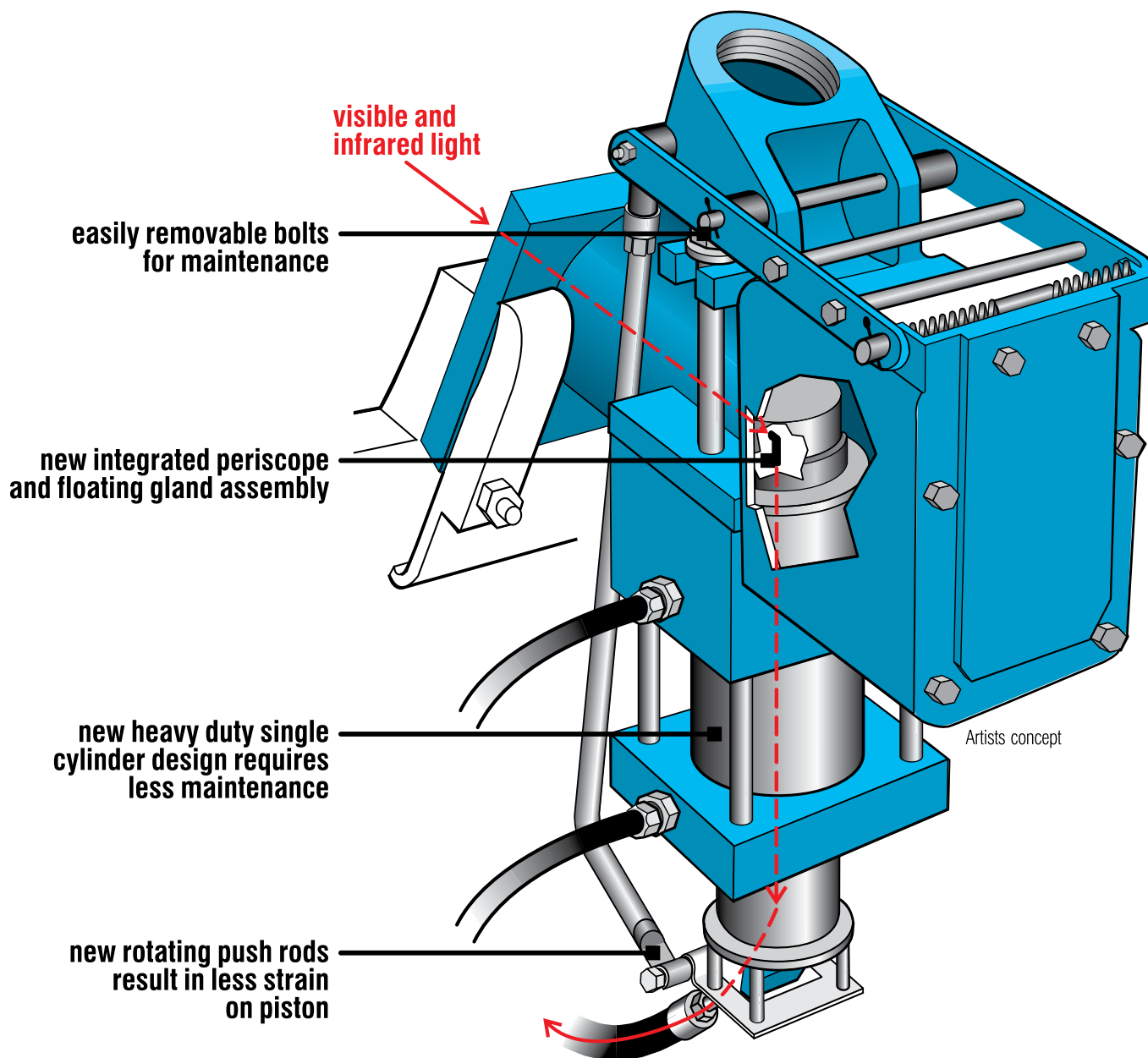
Preliminary experiments indicate that an increase in oxygen enrichment from 21% to 38% raises the temperature reading by about 22 degrees Celsius.

TYPICAL CONFIGURATION

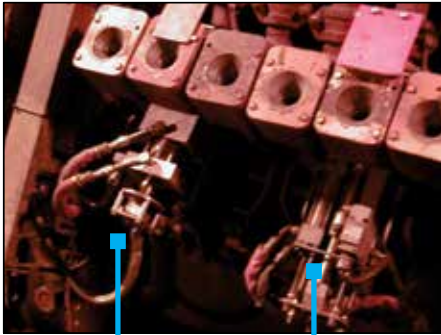
With the introduction of the Tuyere Pyrometer with **Smart Cylinder** the major reasons for tuyere pyrometer failure and damage due to “stuck periscopes” is virtually eliminated. Typically stuck periscopes are caused by either solid caught between the periscope and air bushing, or one or both of the air cylinders used in moving the periscope up down. When failure occurs the periscope is often in the tuyere, unable to move and is destroyed by a punch bar while punching.

Repair of the former dual cylinder model involved removing the entire assembly from the tuyere and having the periscope and fibre optic cable (FOC) returned for costly repairs. The repair often involves the installation of a new periscope assembly with the existing FOC and calibration. In many cases the entire FOC is replaced to ensure correct calibration. Due to the tedious work, repairs to the former system were costly and left operators without reliable temperature measurements for extended periods.

With the development of the **Smart Cylinder** tuyere pyrometer, periscope damage and failure has been virtually eliminated. The previous dual air cylinder system is now replaced by a single robust large bore cylinder with an integrated periscope. With the **Smart Cylinder** tuyere pyrometer it only takes one replacement to save thousands of dollars in down time.



MAJOR COMPONENTS



Smart
Cylinder

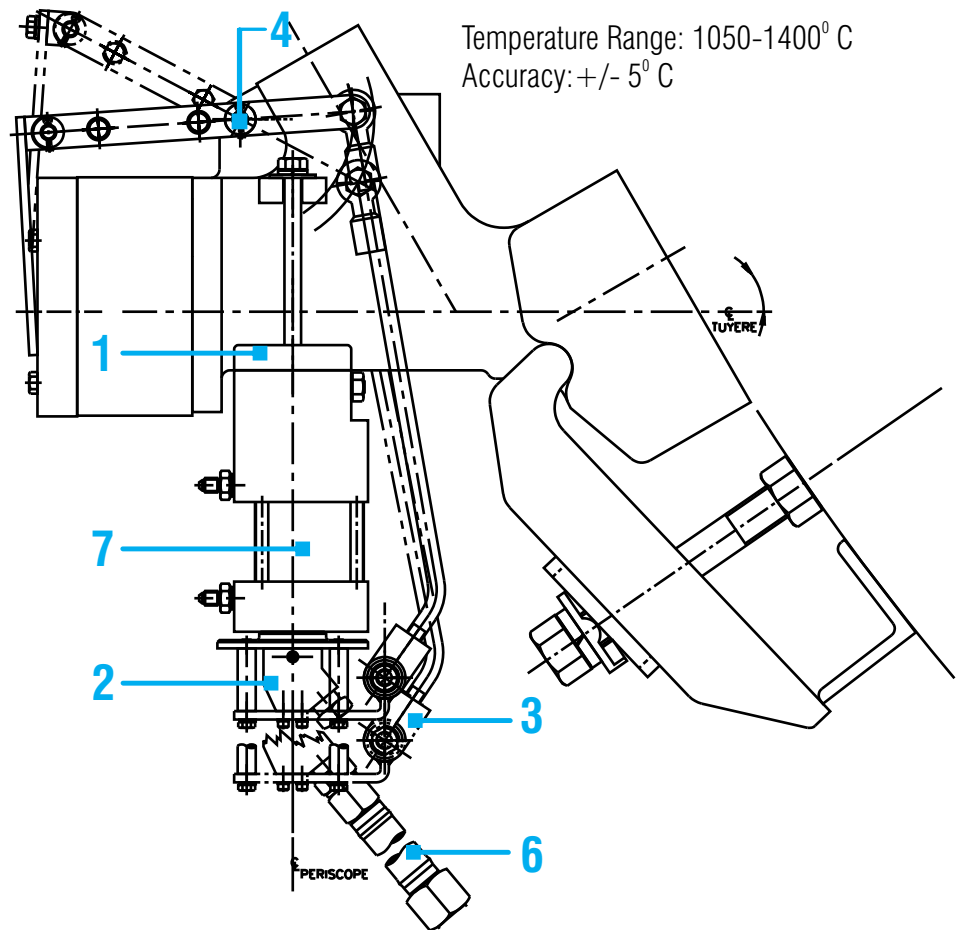
Old
Design



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- 1 new Floating Gland assembly blocks blowback particles from jamming the periscope and helps to prevent smaller particles from contacting the wiper to minimize scratching of the sapphire window
- 2 possible to remove and replace the periscope from the tuyere without removing all associated parts
- 3 push rods rotate at cylinder connection resulting in less strain on piston
- 4 easily removable bolts allow unrestricted removal of the guard plate mechanism
- 5 new internal proximity switch replaces the old style external limit switch. This improvement provides a higher degree of integrity and repeatability that is less prone to physical mechanical damage
- 6 easily up-gradeable using existing periscope/fiber optic cable assemblies
- 7 50% more piston area resulting in smoother up/down movement. New custom heavy duty cylinder eliminates cylinder failures due to thermal stress
 - less parts, fewer air hoses, lighter weight and easier maintenance



Temperature Range: 1050-1400° C
Accuracy: +/- 5° C

The H&S Tuyere Pyrometer with Smart Cylinder is to be installed along with the H&S Periscope Operating System. The H&S Periscope Operating System provides an interlock between the periscope and puncher. By using H&S original and properly functioning Periscope Operating System, accidental punching of the periscope can be eliminated.