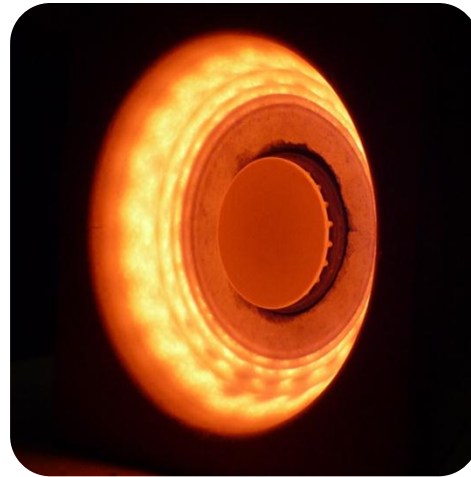


Radiation Burner



HORN Glass Industries AG
R&D Technology and Concept

Author: Mahdie Kamali Moaveni

Contents

- Introduction
- Construction
- Function
- Special features
- Application
- Conclusion

Introduction

Radiation Burner, utilizing high quality refractory material, emits radiant heat precisely to the molten glass without flame impingement.



Introduction

Heat transfer mechanism:

- Conductivity
- Convection
- Radiation

➤ Radiation is dominant heat transfer mechanism at high temperature

$$\text{Radiation energy: } Q = \sigma \cdot \epsilon \cdot A \cdot T^4$$

➤ Glass is a semitransparent media, therefore radiation energy can penetrate significantly into the glass volume.

Construction



Metallic burner pipe and junctions



Insulation block

Burner block

nozzle

Function

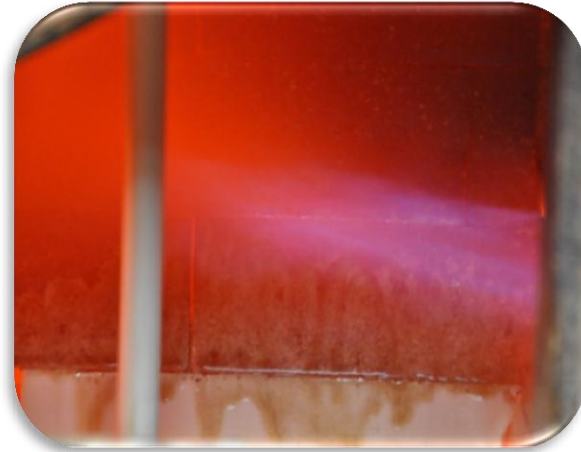
- Special design of burner block:
 - Effective contact of hot combustion gases and burner block surface.
 - High radiation surface area
 - Intensive radiation through sharp edges
- High emissive refractory material will be heated up to white glowing temperature. It creates a source of radiant heat.
- Exposed surface receives the radiant energy.



Special features

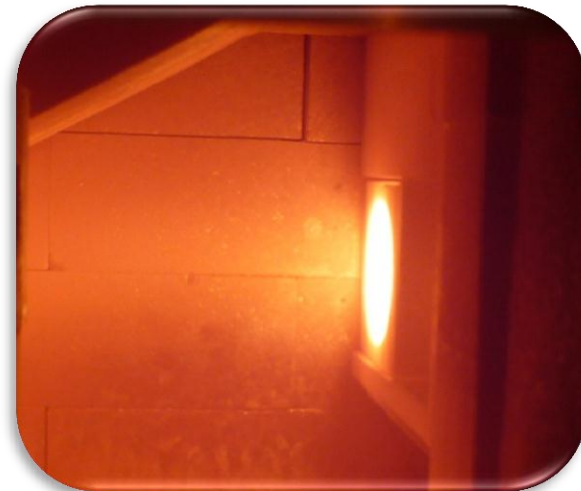
Conventional burner:

- Long flame
- Radiation from hot combustion gases to glass and surrounding refractory
- Convection from hot combustion gases to glass and surrounding refractory



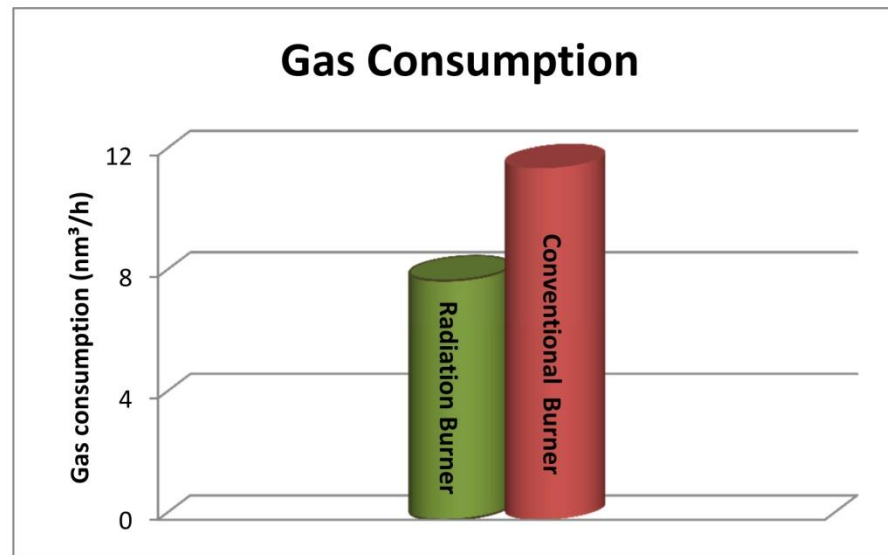
Radiation burner:

- Flat flame
- Focused radiation to glass surface
- Convection from hot combustion gases to glass and surrounding refractory



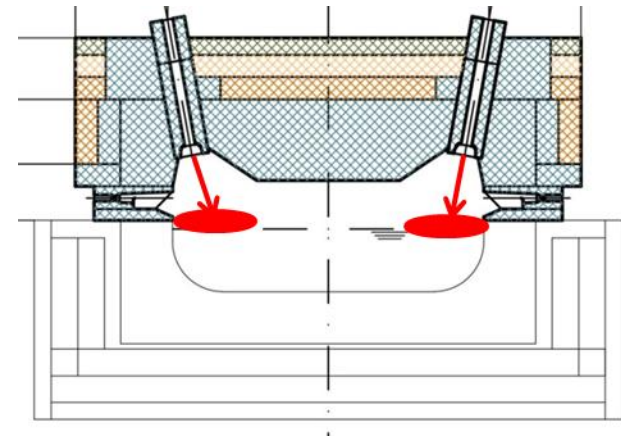
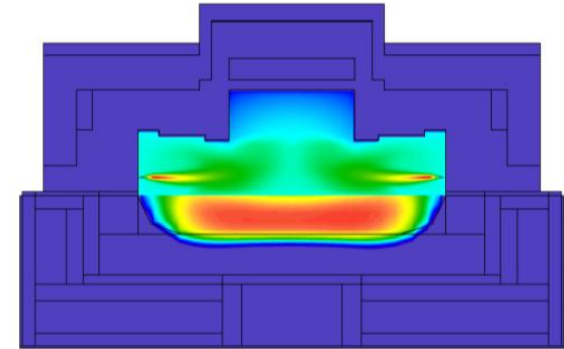
Special features

- Higher heating efficiency
 - >>> Lower energy consumption over 30%



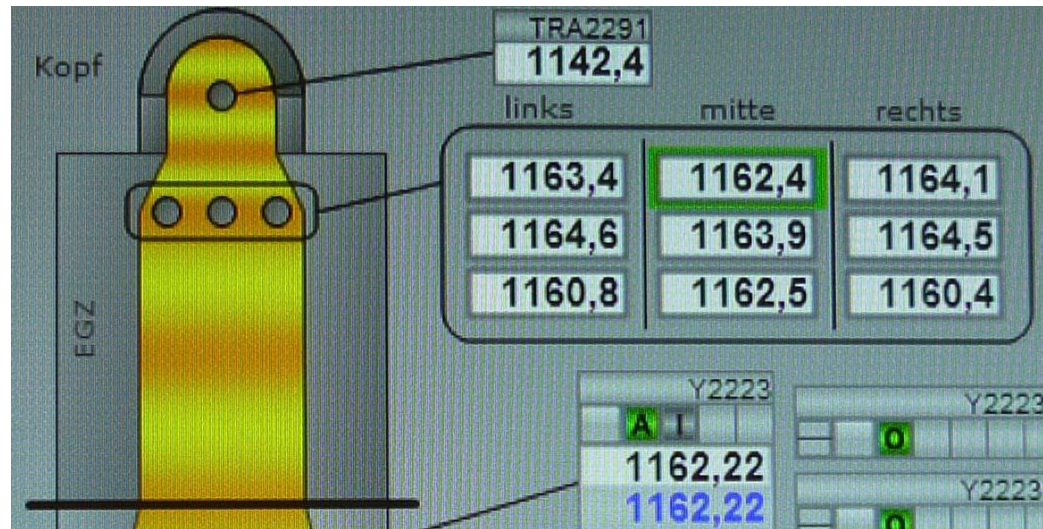
Special features

- Focused heat transfer to each sides without influence on center line and other side
- >>>Independent control of left/right forehearth temperature
- No flame impingement



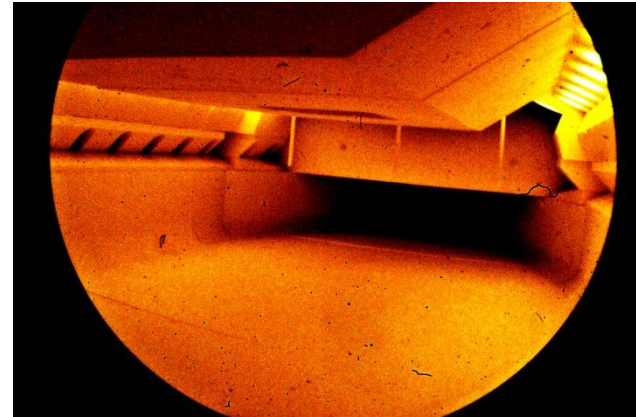
Special features

- High impact on bottom glass layer
 - >>>improvement of thermal homogeneity, K factor up to 99%, suitable for difficult glass like dark colored glasses



Special features

- Uniform heat radiation over desired area
- Applicable with usual Gas-Air mixture facilities as well as conventional burners.
- Short response time during job change
 - >>> Glass temperature stability in short time
- Suitable for natural gas and LPG

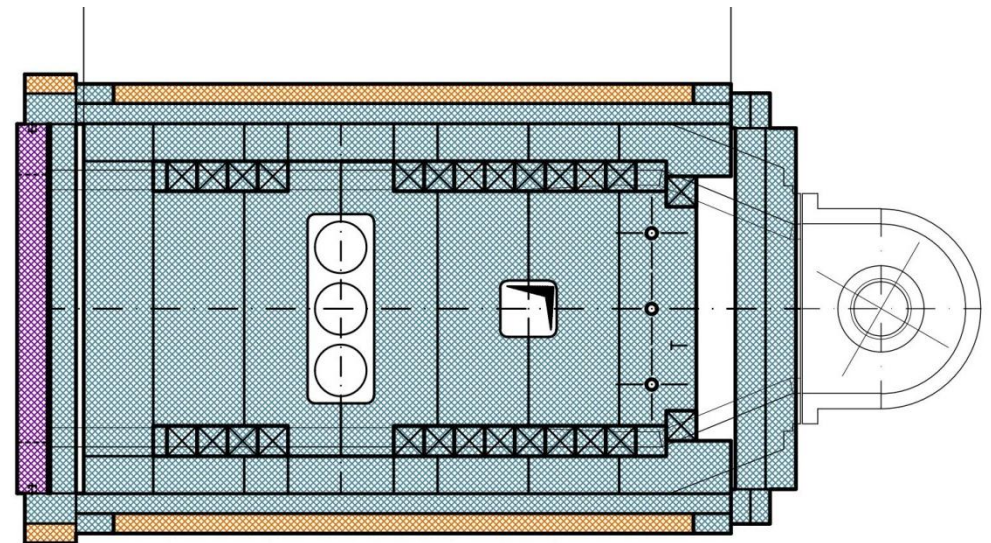
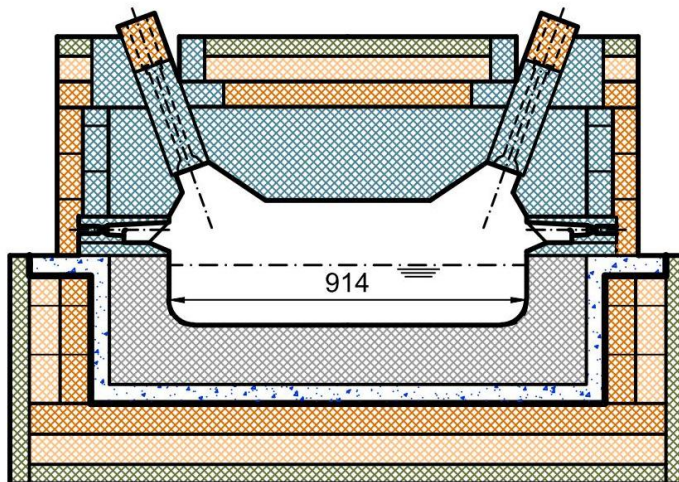


Application

Container glass / Tableware

➤ Equalizing zone

High thermal homogeneity



Application

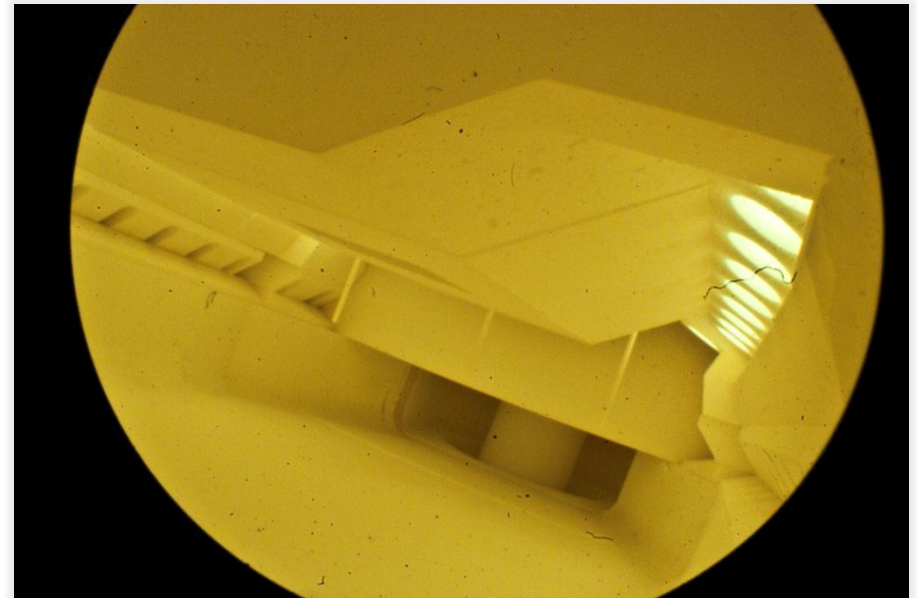
➤ Equalizing zone



Application

➤ Equalizing zone

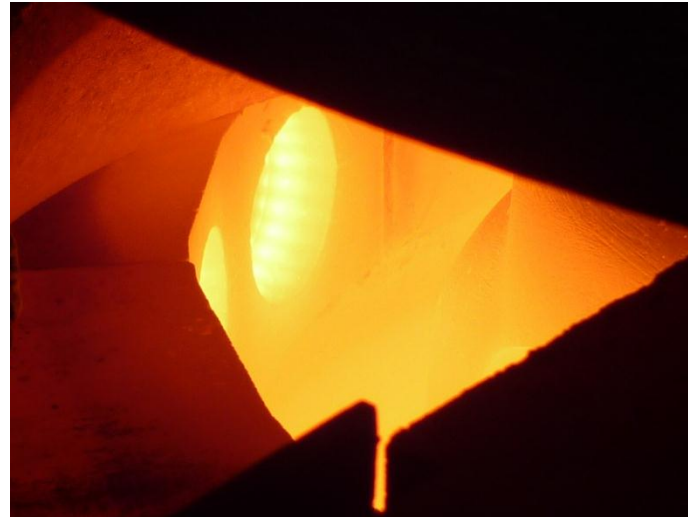
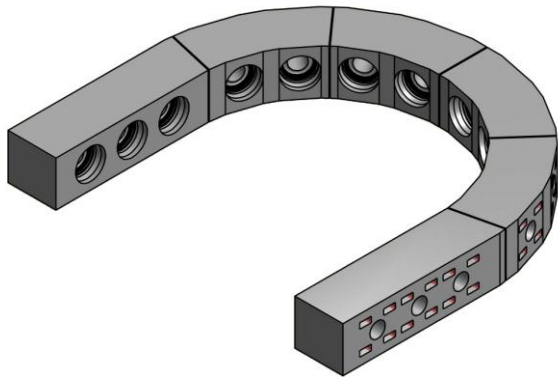
Inside view before and after heatup



Application

➤ Spout

Uniform and smooth heating



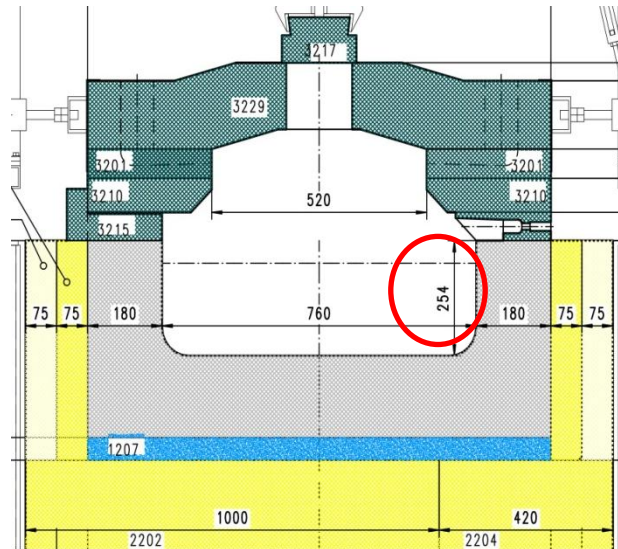
Application

Fiber glass / glass tube production

➤ Deep forehearth

Effective heating in deep forehearth

Low energy consumption

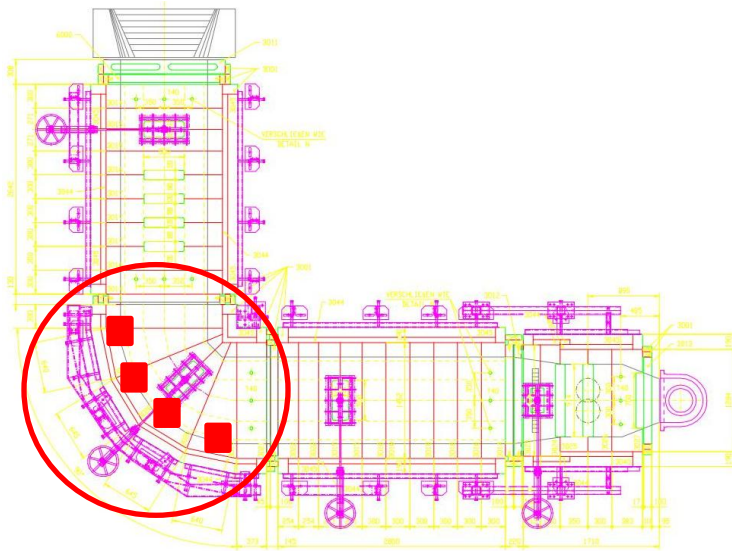


Vello, glass tube production

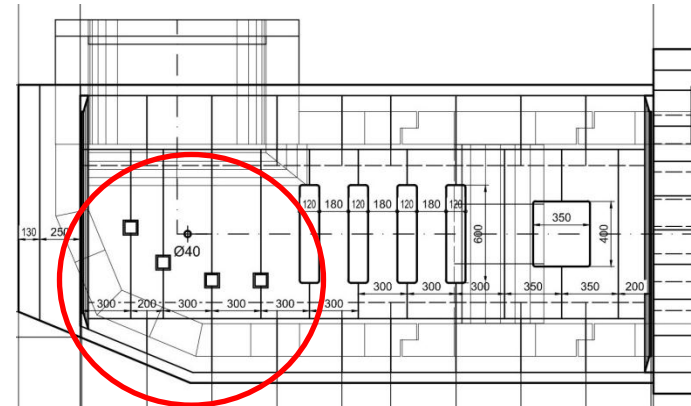
Application

➤ Asymmetric Geometry

precise heating



Forehearth



Distributor

Application

➤ **Dark colored glass**

Difficult thermal conditioning of dark colored glass

High impact on glass depth

Conclusion

Radiation burner provides:

- Fast and controlled heating
- Improvement of glass conditioning in distributor and forehearth
- Fuel saving over 30%
- Uniform and smooth heating
- Useful for temperature fine tuning in difficult condition