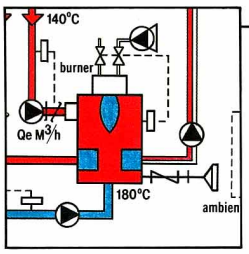


RAPID HEATING OF METALS IN A FORGE FURNACE : ANOTHER NATURAL GAS APPLICATION

SITUATION

The steel and engineering industries sometimes require metal pieces to be heated in a forge furnace at a temperature of up to 1,150°C prior to forming.

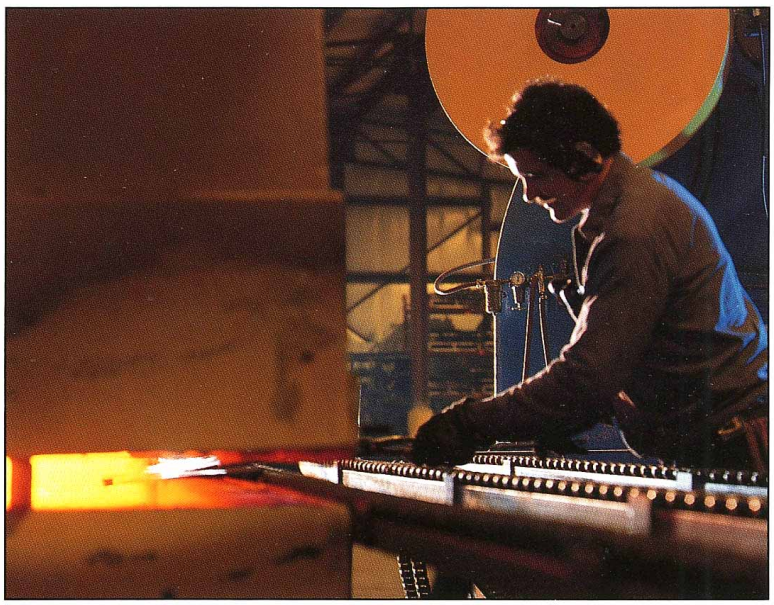
PROBLEM

Due to new industry requirements, conventional forge furnaces can no longer meet expected performance, productivity and product quality levels.

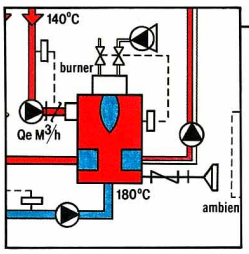
The overall efficiency of a conventional forge furnace is generally rated at about 4-5% (H HV), with steady state performance reaching 7-8% (H HV). Also, reliability and maintenance costs of induction furnaces do not always meet industry standards.

SOLUTION

The rapid heating furnace - an advanced gas technology - provides the perfect solution.



Rapid heating furnace



BENEFITS

- Possibility of reducing energy consumption by up to 75% as a result of low thermal inertia, accurate regulation and load preheating;
- Increased productivity;
- A compact furnace means lower capital and maintenance costs;
- Flexibility of operation making it possible to heat pieces of various shapes simultaneously;
- Improved working environment;
- Good product quality due to low scaling.

THEORY

Simultaneous lower energy consumption and shorter manufacturing cycles for industrial processes were achieved by implementing two complementary applications: medium and high velocity output burners combined with ceramic fiber refractory.

It is estimated that high velocity burners (jet burners) release combustion products with consider-able kinetic energy at a gas velocity of 100 m/sec. The industry also uses nozzle mix burners; although these operate at lower speeds, they nevertheless provide a high turbulence rate inside the furnace as well as thorough and uniform heating of the stock.

The silico-aluminum ceramic fibers refractory look like felt or rigid plates. They are efficient up to 1,400°C and can be used to build furnaces operated with sulphur-free fuels such as natural gas. Due to the very low density (01-0.2) and the excellent insulating properties of this refractory material, response time to temperature variations is very short.

These rapid heating furnaces require more sophisticated control and regulation devices than conventional equipment; because of the remarkably low thermal inertia of the furnace, it is possible to achieve extreme temperature changes within a few minutes; this requires a highly flexible regulation system able to operate over a much shorter period.

It is of the utmost importance for production and furnace capacity to be compatible to get the most benefit out of this type of equipment.

The furnace thermal efficiency according to its steady state production rate appears on the following diagram (see figure 1). It appears that to achieve optimum efficiency, a given furnace has to be operated at a production rate matching its lowest specific consumption.

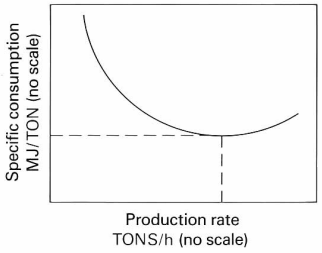


Figure 1:
THERMAL EFFICIENCY OF THE FURNACE

FURNACE DESCRIPTION

The pieces to be heated are placed manually on a conveyor belt outside the furnace. The belt carries the pieces against the flow of combustion products through a narrow channel between the ceiling and the base of the furnace towards burners located at the other end. When the metal pieces arrive at the far side, they have reached the desired temperature and are removed manually by an operator. See figures 2 and 3.

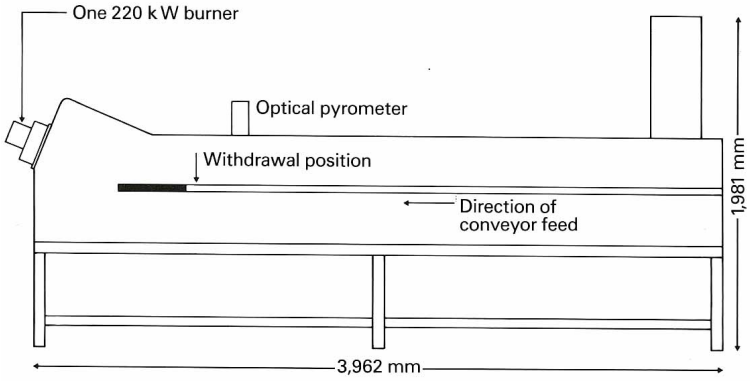


Figure 2: RAPID HEATING FURNACE

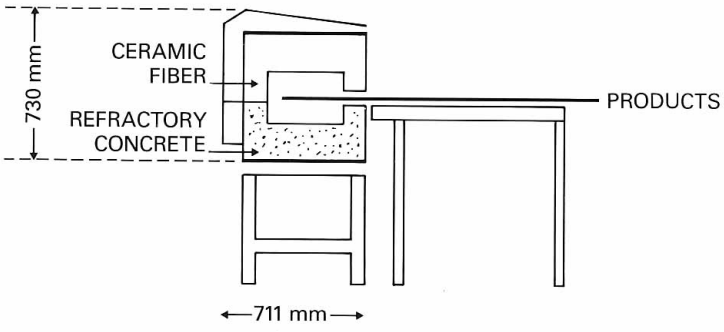
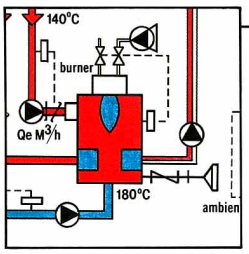


Figure 3: CROSS SECTION

Because of the furnace's fast response time, a mere 10-15 minutes elapse between burner start-up time and the first piece of stock reaching 1,150°C. This is due to the ceramic fiber insulation assuring a low thermal inertia and, consequently, a short warm up period. In addition, such a fast response time makes it possible to change the operating temperature of the furnace on request.

In case of a temporary production shut-down, the burners may be left on low fire; it then takes less than two to three minutes for the stock temperature to go down below 900°C, thus avoiding decarburization and scale build-up. It only takes a few minutes to return to normal operating conditions.

Further automation of other furnace-related operations is also possible by adding extra equipment such as a special device that will remove the piece from the furnace as soon as it has reached the required temperature. It is even possible to achieve complete automation of the entire operation including heating and forging to reach higher performance levels.



OTHER APPLICATIONS

Rapid heating may be applied to most processes where metal heating is required, including:

- Metal sheet rolling;
- Pressing;
- Extruding;
- Hot forming.

This technique may be applied to ferrous as well as non-ferrous metals.

SUMMARY 0F BENEFITS

- Energy savings of up to 75%
- Higher productivity
- Lower investment and maintenance costs
- Better working environment
- Improved product quality

For more information, contact

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