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CHEMICAL PROPERTY MODIFICATION SYSTEM FOR HOT FORMED PARTS FOR STRENGTH MODIFICATION

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Technical task:
For the production of press-hardened parts, the blanks are heated to the recrystallization temperature (approx. 950 °C) of a material in a furnace in the first production step (austenitizing). In the second step, hardening takes place during forming and shaping and cooling in the die, which hardens the components. In the next process step, the components are laser cut, see Figure 1.
In order to realize tailored properties, there are different manufacturing processes such as partially heated tools, flowing with air in and outside the furnace, cooling by cooled plates as well as via a welded blank (TWB) with a material mix.

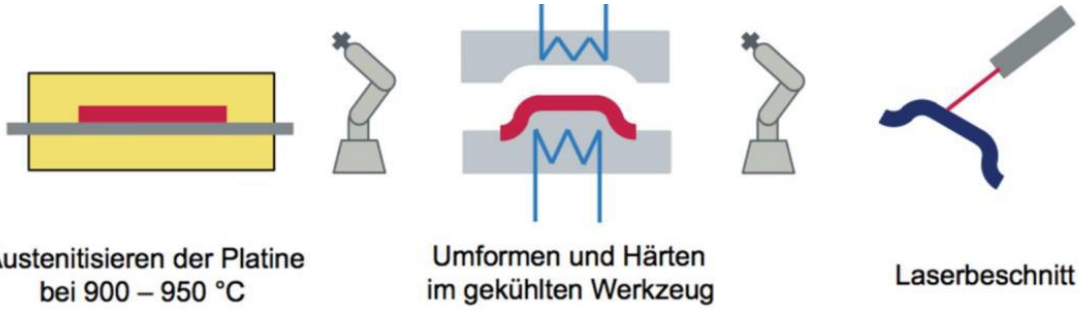

Figure 1

Disadvantage:
Very expensive due to additional process step/ additional material

Solution:
By introducing additional nozzles in the furnace process, through which a heated gas (oxygen) is applied to the components, the chemical composition changes.

Advantages:
- No additional process step due to thermal printer
- No additional welding seam/material

Possible application:
In this solution, the strength of the board is changed by specifically changing the chemical composition. Specifically, the carbon content is reduced. By reducing the carbon content, the subsequent strength (hardening through martensite formation) is influenced.

The blank passes through the furnace (roller hearth furnace) and is heated up (Figure 2). During this process, it passes several times through the area with the gas nozzles.
These nozzles distribute a hot gas in a targeted manner (temperature >= oven).
Thus always a certain area of the board upper side and lower side can be blown on. The gas used here is oxygen.

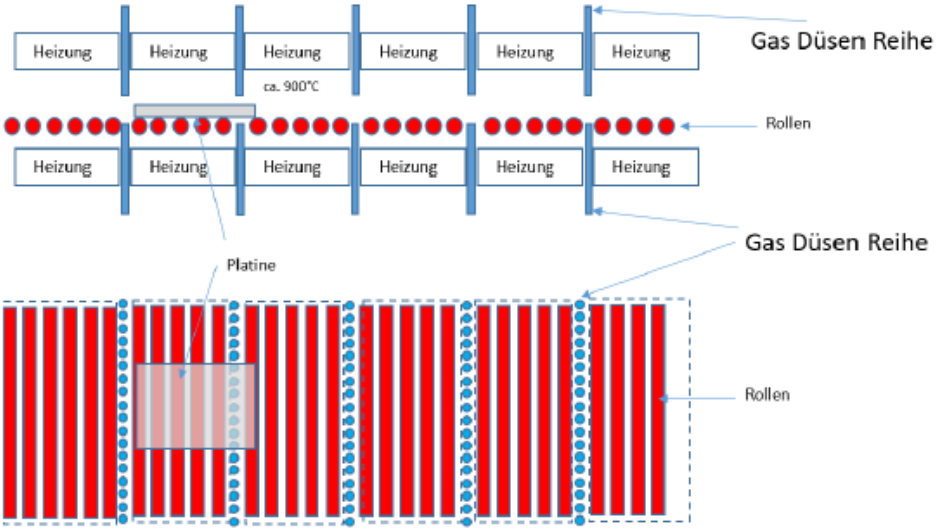

Figure 2

The high concentration of oxygen on the surface of the blank due to blowing causes the carbon on the surface to be converted to carbon dioxide (Figure 3). The high affinity of carbon to oxygen and, in addition, the diffusion of carbon into the surface layer due to the difference in concentration, cause a decrease in the carbon content of the blank, which leads to a change in properties after the cooling process in the mold.

Bsp. Gas Düsen:

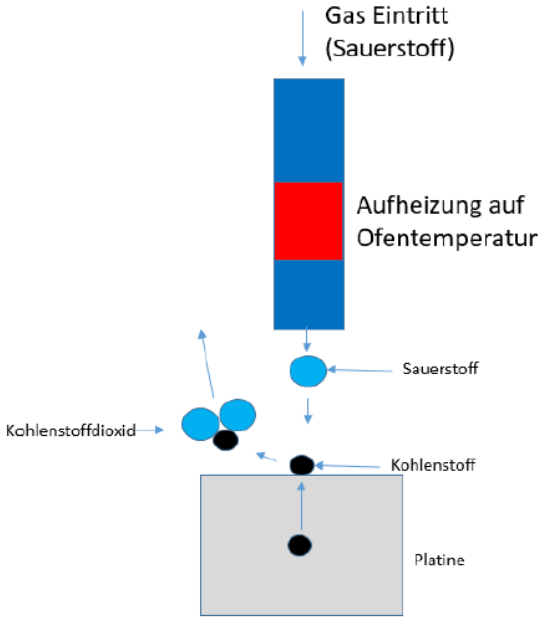

Figure 3