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Takahashi

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[54] **ATMOSPHERE ISOLATING MEANS IN A CONTINUOUS-TYPE FURNACE**

[76] Inventor: **Susumu Takahashi,** 12/21, 5-chome, Wakabaya, Setagaya-ku, Tokyo, Japan

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[51] **Int. Cl.**[2] **F27B 9/04**

[58] **Field of Search** 432/152, 128, 143, 144; 34/242

[56] **References Cited**

UNITED STATES PATENTS

2,200,619	5/1940	Fallon	432/242 X
3,189,336	6/1965	Montagino	432/152 X
3,415,503	12/1968	Beck	432/152 X
3,467,366	9/1969	Westeren et al.	432/152 X

Primary Examiner—John J. Camby

Attorney, Agent, or Firm—Shlesinger, Fitzsimmons & Shlesinger

[57] **ABSTRACT**

Means for adjusting and maintaining the gas atmosphere in each zone of a continuous-type furnace. The means comprises a plurality of curtain-like units suspended one after the other and freely over the articles being conveyed on a conveyor belt for heat-treatment. A proper sealing effect between the adjoining zones of the furnace is obtained so that the heat-treatment may be conducted under optimum atmospheric and thermal operating conditions.

2 Claims, 4 Drawing Figures

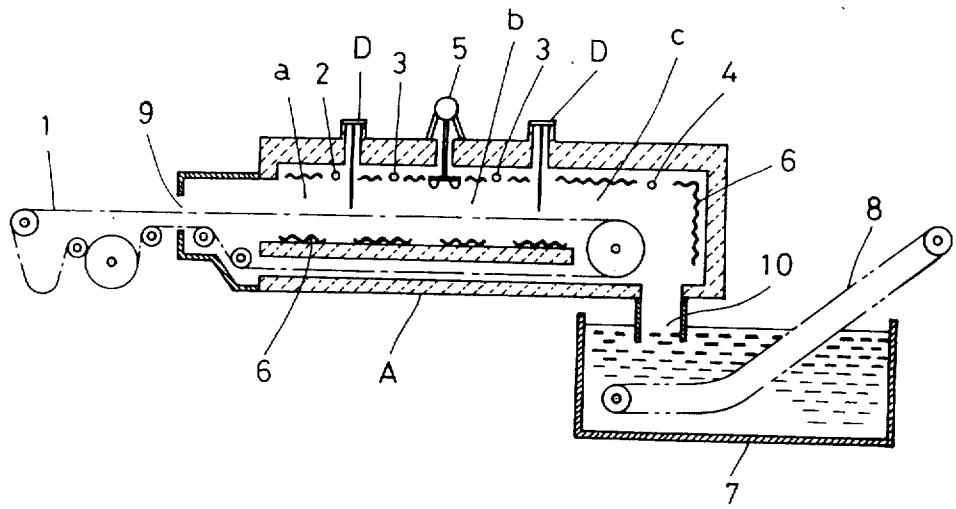


FIG. 1

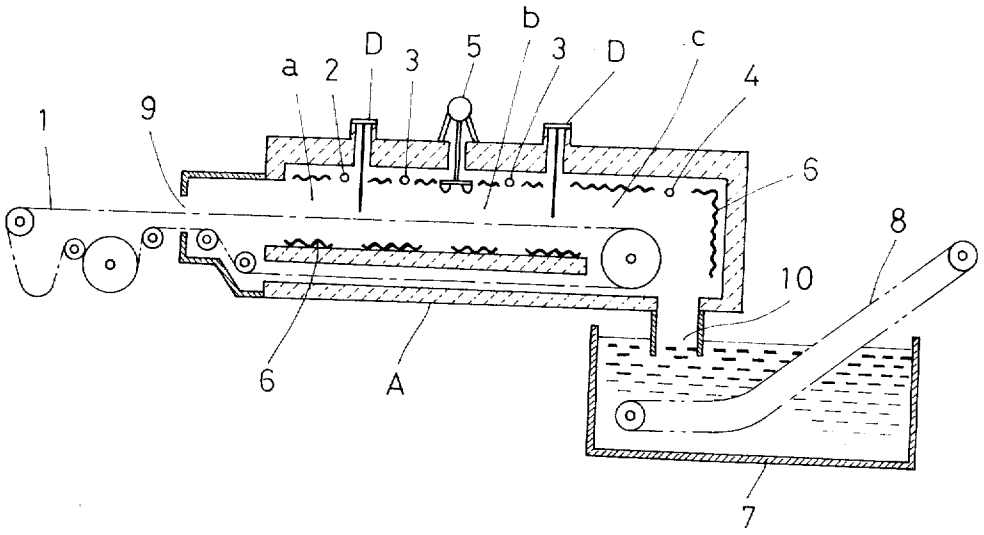


FIG. 2

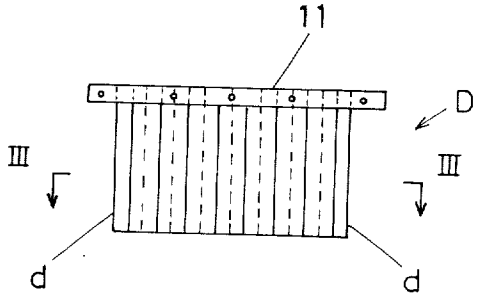


FIG. 3

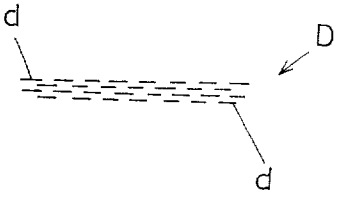
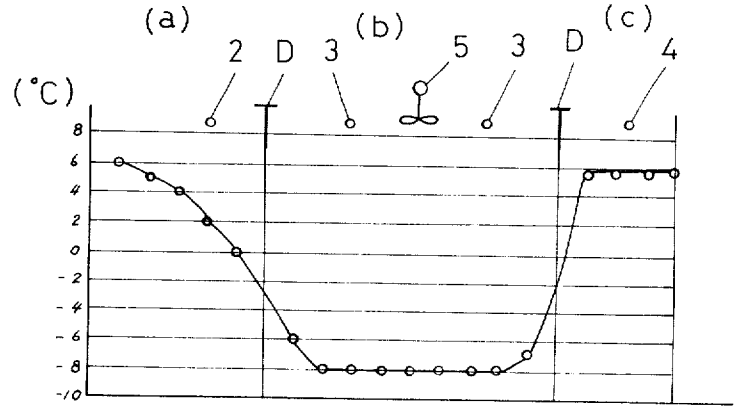


FIG 4



ATMOSPHERE ISOLATING MEANS IN A CONTINUOUS-TYPE FURNACE

This invention relates to an improved device for adjusting and maintaining the gas atmosphere in continuous-type furnaces such as a conveyor belt type gas-atmosphere heating furnace.

Heretofore, in this type of heating furnace wherein the conveyor belt is moved consecutively through the heating, carburizing and diffusing zones for continuous heat treatment operation, a so-called drop arch type unit is employed as a curtain for partitioning said zones from one another and separately controlling the atmosphere in each of such zones. In order to minimize the gap between the arch and the articles to be processed, the arch must be shaped and sized to conform to the articles occasionally processed in the furnace, thus complicating the structure to the device and making it necessary to use the different types of arch structure for each heat treating operation. In this known furnace, when the carbon potential of the gas atmosphere within the heating zone is equal to that of the gas atmosphere for the carburizing zone, the progress of carburizing is affected adversely on account of carbon precipitation on the article surface at the heating zone. It shall be noted also that after carburizing, the temperature has to be lowered from a carburizing temperature of 900°C for example to the quenching temperature of 830°C for example for the subsequent quenching operation, and if it is desired to diffuse the carbon deep from the surface of the article, the carbon potential at the diffusing zone must be lowered necessarily under that prescribed for the carburizing zone. Hence, a certain possitive isolating device has to be provided between the zones, while the such device shall not prevent the free transferring movement of articles. Moreover, in the case of carburizing to a shallower depth, the gas atmosphere must have a well-defined carbon potential for the respective zones to heighten the accuracy in the carburizing depth.

Hence, it is the principal object of the present invention to provide a device for adjusting and maintaining the gas atmosphere in the carburizing furnace whereby the above inconvenience may be obviated.

The present invention will be described below by referring to the accompanying drawing showing a preferred embodiment thereof.

In the drawing:

FIG. **1** is a schematic side elevation, partly in cross-section, of the overall heating furnace;

FIG. **2** is a front view of a curtain device which isolates adjacent zones;

FIG. **3** is a sectional view taken on line III—III of FIG.2; and

FIG. **4** is a graph showing dew points measured at several points within the furnace provided with this invention isolating means.

Referring to FIG. 1 showing the overall continuous-type heating furnace A, **1** designates a conveyor belt of the mesh type for transporting the articles to be heat treated, **2** an inlet for the carrier gas, **3** an inlet for the carrier gas and the carburizing gas, **4** an inlet for the carrier gas to be used in a diffusing zone *c*, 5 an agitator, 6 heaters, 7 a quenching oil bath, *a* a heating zone, and *b* a carburizing zone. The furnace is provided with an inlet **9** and outlet **10.** These inlet and outlet openings may be closed by pivotal doors (not shown). The oil quenching bath 7 is provided with a conveyor **8** which takes out carburized articles from the bath.

D designates a curtain comprising more than two overlapped sets of steel plates or segments *d*, each said set consisting of a plurality of the aligned or juxtaposed segments *d* each of which is formed as a thin band of heating resistant steel. These sets of steel segments *d* are so placed that the individual segments of one set are staggered relative to those of the other set of the segments *d*. These segments *d* are secured at the upper ends to a support member **11** so that their lower ends are left loose and depend in the form of a blind or a rope curtain. These curtains D are provided as isolating means between the heating zone *a* and the carburizing zone *b*, and between the carburizing zone *b* and the diffusion zone *c*, so that the supporting members **11** are secured at the upper part of the furnace A and the lower portions of the curtain are hung freely above the conveyor belt **1.**

In the heat treating operation, the respective zones *a*, *b* and *c* are effectively divided from one another by these curtains D which are hung freely above the articles placed on the moving belt, so that these curtains D are flung open by the proceeding articles irrespective of the article size, and a proper sealing effect may be attained with these curtains D. Thus, the gases in the zones *a*, *b*, *c* may be kept at the respective temperatures and compositions suited for the heat treatment to be conducted in the heating furance. Besides, a more accurate control of the carbon concentration and the depth of carbon penetration are possible with the above arrangement.

Next, the present invention will be explained in connection with the following numerical example.

EXAMPLE

A steel plate (SPCC) 1 mm. thick was used as a sample for carburizing and nitriding to obtain an HRV surface hardness higher than 770 and a depth of carbon penetration in the range of 0.08 to 0.15 mm. The carburizing zone *b* was kept at 810°C. A gas at a dew point of 4°C was introduced from the inlet **2** as atmosphere in the heating zone. A carrier gas at the dew point of 4°C added with carburizing atmospheric gases of 1 percent of propane and 2 percent of ammonia was introduced from the inlets **3, 3.** A gas at the dew point of 4°C was introduced from the inlet **4.** The oil quenching bath was maintained at 60°C. Th test sample No. **1** was designed to pass through the carburizing zone in 30 minutes, while the test sample No. **2** was designed to pass through the same zone in 60 minutes, as tabulated in the following Table with the test results. The transition in the dew points as measured at various points inside the furnace is shown graphically in the chart of FIG. **4,** in which ordinate indicates the temperature (°C) of dew points and abscissa indicates measuring points in the furnace.

Table

Test Sample	Number of samples	Surface Hardness(HRV)
No. 1	100 pieces	820 – 850
No. 2	100 pieces	830 – 870

Test Sample	Depth of Penetration (mm)	Carburizing Temp.(°C)	Carburizing Time(minutes)
No. 1	0.10 – 0.14	810	30

Table-Continued

Test Sample	Number of samples	Surface Hardness(HRV)	
No. 2	0.22-025	810	60

It will be seen from FIG. 4 and the above Table that the arrangement of this invention enables the temperatures and dew points of the respective zones of the furnace to be demarcated definitely from one another in accordance with the requirement for the carburizing operation being conducted in the furnace.

According to this invention, a proper isolating effect between the adjoining zones is attained by the curtains D which may be flung open by the proceeding articles in conformity to the shape and size of the articles. Moreover, the carbon potential of the gas atmosphere may be adjusted and maintained at a highly accurate level so that the heat treatment may be conducted under the optimum operating conditions.

What is claimed is:

1. In combination with a continuous-type furnace in which articles to be treated are transferred by conveyor means through a plurality of treating zones, means for controlling and maintaining gas atmospheres for such zones comprising a plurality of curtains arranged one closely after the other, each said curtain comprising a plurality of sets of metal segments, which are all of the same height, the segments of each set being arranged in alignment laterally but being staggered relative to those of the next adjacent set, said curtains constituting isolating means between the adjacent zones, and being freely suspended above the conveyor means for isolating the atmospheres supplied to ssiad zones from one another and for allowing the articles to freely pass through the zones via said isolating means.

2. Isolating means as claimed in claim 1, in which the segments are thermally resistive thin metallic strips.

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