March 5, 1940. C. I. HAYES 2,192,191

HEAT TREATMENT ATMOSPHERE

Filed July 26, 1935 2 Sheets-Sheet 1

Fig. 1

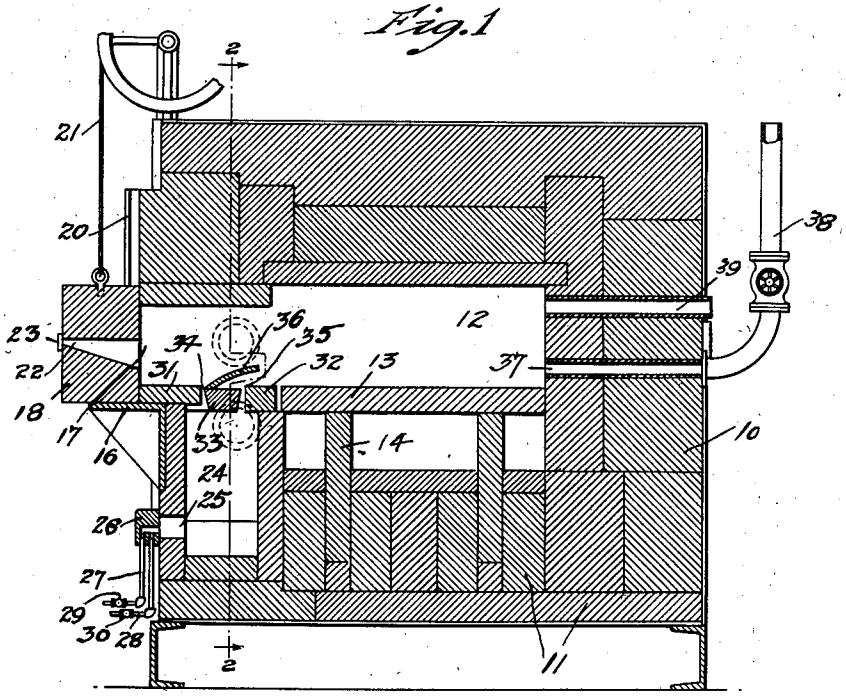
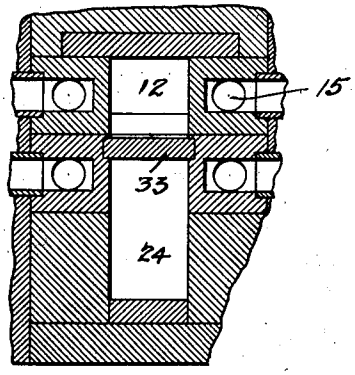


Fig. 2



Inventor
Carl I. Hayes

By Nathaniel Frucht
Attorney

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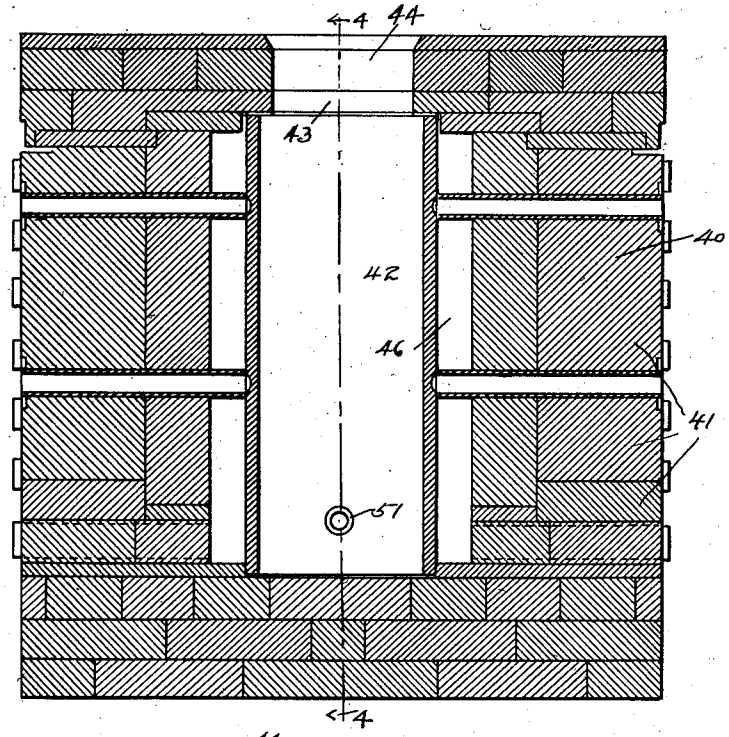
Fig. 3



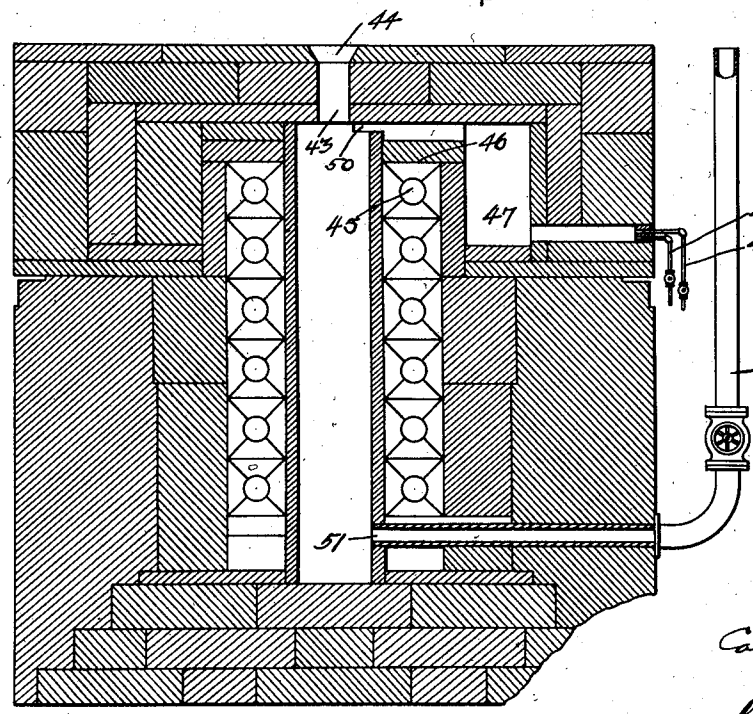


Fig. 4

Inventor
Carl I. Hayes
By Nathaniel Frucht
Attorney

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UNITED STATES PATENT OFFICE

2,192,191

HEAT TREATMENT ATMOSPHERE

Carl I. Hayes, Providence, R. I.

Application July 26, 1935, Serial No. 33,374

1 Claim. (Cl. 263—41)

My present invention relates to heat treatment of materials, and has particular reference to the maintenance of suitable atmospheric conditions during the heat treatment.

The heat treatment of materials, and particularly steels, has preferably been accomplished as disclosed in Hayes Patent No. 1,724,583 by subjecting the material to a predetermined temperature in a heating chamber which enveloping the material in an atmosphere of predetermined constituency, selected to be neutral to the material or to provide a positive check against undesirable treatment effects.

The excellence of the heat treatment, its uniformity, and the absence of undesirable treatment effects depend on the uniformity of the enveloping atmosphere; it has been found that this uniformity may be and is affected by changes in operating room conditions, and that compensation for such changes is desirable, as explained in Hayes Patent No. 1,851,831.

It has also been found that changes in the enveloping atmosphere take place in the heat treatment chamber, and particularly in the presence of steels, refractories, and other materials, and when the enveloping atmosphere is subject to high temperatures for extended periods of time. These changes are due either to fatigue, or decrease of the affinity characteristics of the constituent gases, or to an actual variation in the constituency as a result of extended contact and interchange of constituents with the materials undergoing heat treatment. This tendency is increased when the flow of the atmosphere gases is decreased, as when the furnace door is in closed position.

It is the principal object of my invention to provide an arrangement whereby the enveloping atmosphere in the heat treatment chamber is continually maintained at its most effective condition.

Extended tests have shown that the portion of the atmosphere which is directly in contact with the material is most likely to become deadened or affected by the contact materials, or fatigued. It is therefore a further object of my invention to constantly change or replenish the atmosphere which is directly in contact with the material.

With the above and other objects and advantageous features in view, the invention consists of a novel method and a novel arrangement of parts more fully disclosed in the detailed description following, in conjunction with the accompanying drawings, and more specifically defined in the claim appended thereto.

In the drawings,

Fig. 1 is a central vertical section through a horizontal type heat treatment furnace equipped with the novel invention;

Fig. 2 is a section of Fig. 1 on the line 2—2 thereof;

Fig. 3 is a central vertical section through a vertical type heat treatment furnace, and

Fig. 4 is a section on the line 4—4 of Fig. 3.

It has been found desirable to design a heat treatment furnace with an arrangement for establishing an enveloping atmosphere of definite, predetermined constituency within the heat treatment chamber. The atmosphere being inert to the material undergoing treatment, or having characteristics which prevent undesirable treatment effects. The preferred atmosphere consists of combusted gases having definite percentages of carbon dioxide, oxygen, carbon monoxide, and other gaseous constituents. Since the gases when subjected to prolonged heating at high temperatures in the presence of material undergoing treatment become fatigued, deadened, or perhaps slightly changed, I have devised a construction for obtaining a continuous, steady change or replenishment of the atmosphere directly engaging the material.

Referring to the drawings, the furnace casing 10 of the horizontal type furnace is of usual construction, and is lined with insulating blocks 11 of different sizes to provide a central heat treatment chamber 12 which has a work receiving hearth 13 supported within the chamber on the usual standards 14. The illustrated furnace is of the muffle type, and may be heated in any desired manner, the preferred heating being electrical and including a plurality of high temperature resistance bars 15 mounted in proximity to the walls of the chamber 12 and having the standard electrical contacts in suitable recesses in the furnace casing.

The voltage is controlled by any standard type of rheostat, not shown. The heat treatment chamber 12 has a throat opening 16 and a mouth 17 for entrance and removal of work; a door 18 of usual formation normally seats on the support shelf 19 to close the mouth 17, and is liftable upwardly within guide plates 20 by manual lifting mechanism 21 of any suitable construction to expose the mouth of the furnace. The door is equipped with the usual peep channel 22 closed by a metal cover 23, in order to permit inspection of the interior of the furnace when the door is in closed position.

A combustion chamber 24 is provided beneath

the throat 16 with an inlet opening 25 which is normally closed by a supply member 26 receiving air and gas under pressure through pipes 27, 28, these pipes being preferably equipped with hand control valves 29, 30. The upper end of the combustion chamber is constricted as shown in Fig. 1 by spaced throat plates 31 and 32 and an intermediate plate 33 which is tapered as shown and is suitably mounted to provide two spaced slots 34, 35 for controlling outlet of the combusted gases from the combustion chamber. A baffle plate 36 is secured to the plate 33, as shown in Fig. 1, and extends rearwardly and over the slot 35 so as to direct the gases along the work receiving hearth, and towards an outlet channel 37 adjacent the hearth end, which has a valve controlled outlet pipe 38 communicating therewith. The temperature within the heat treatment chamber is measured by the usual pyrometer, mounted in the pyrometer bore 39.

When a mixture of air and gas of predetermined proportions and under pressure is admitted into the combustion chamber through the inlet opening 25, it may be ignited at either slot, and the flame immediately travels back because of the tapered formation of the slots to produce the desired combustion within the combustion chamber. The combustion gases emerge from the combustion chamber through both slots, the gases from the slot 35 being directed rearwardly to form a gaseous curtain which completely fills the heat treating chamber and eliminates all atmospheric air within two or three minutes to fill the heat treating chamber with an atmosphere of predetermined constituency.

The gases emerging from the slot 34 are directed forwardly to form an air excluding curtain across the mouth of the furnace, thus preventing access of atmospheric air to the gases forming the inner curtain.

The baffle and the outlet channel function to continually change the atmosphere in the vicinity of the material undergoing heat treatment, whereby the desired atmosphere always envelops the material. Since a slow change is desired, it is possible to use the baffle alone, in small furnace constructions, the gases from slot 35 then displacing the gas layer adjacent the hearth, which outlets through the peep hole 23, or it is possible to use the outlet channel and its outlet pipe alone, a slow steady gas flow across the hearth being obtained; it is however, preferable to use both the baffle and the gas outlet parts.

The use of an outlet channel and an outlet pipe, as described supra, is particularly desirable with vertical type furnaces such as illustrated in Figs. 3 and 4. In this construction the furnace casing 40 is constructed of insulating blocks 41 to provide a vertical central heat treating chamber 42 having an entrance throat 43 and a mouth 44, the chamber 42 being electrically heated by a plurality of high temperature resistance bars 45 mounted in recesses 46, the voltage being controlled by a standard type rheostat. A combustion chamber 47 is provided beneath the throat to receive gas and air under pressure through valve controlled inlet pipes 48, 49, and the products of combustion, which are of definite predetermined constituency, pass through a slot 50 and into the central heating chamber. The throat opening is closed by a door of standard type during the heating operation, the material to be heat treated being normally suspended into the central chamber in baskets or racks, or laid directly on the hearth. An outlet opening 51 is provided at the lower end of the chamber, and communicates with a valve controlled outlet pipe 52, whereby a steady, regulated circulation of the enveloping atmosphere through the heat treatment chamber is obtained.

It is therefore clear that the novel construction described results in a steady movement of the enveloping atmosphere immediately adjacent the material undergoing heat treatment, whereby the material is constantly bathed in fresh gases of a predetermined constituency, this constituency being definite for each material. Thus, when treating high speed steels, it is desirable to have a definite percentage of CO, in order to obtain desirable surface and internal conditions in the heat treated steel; steels such as high chromium, high carbon steels, require a percentage of CO in the neighborhood of 12%, whereas other steels, such as vanadium alloy and stainless steels, require a definite percentage of O_2.

Although I have described specific constructional embodiments for carrying out my invention, it is obvious that the method of continual removal and replacement of the enveloping atmosphere adjacent the heat treated material, and the apparatus for accomplishing this change of enveloping atmosphere, may be changed to suit different heat treating requirements and furnace constructions, without departing from the spirit and the scope of the invention as defined in the appended claim.

I claim:

In combination, a heat treatment furnace, a muffle therein having a door opening and a hearth, a combustion chamber, means for supplying regulated quantities of gas and air to said combustion chamber to obtain combusted gases of definite predetermined constituency, means for conducting said combusted gases to said muffle adjacent the door opening to fill said muffle and to exclude external air and form an enveloping atmosphere for material positioned on said hearth for heat treatment, means for maintaining the definite predetermined constituency of the enveloping gases adjacent the material undergoing heat treatment comprising a gas withdrawal duct having an inlet adjacent said hearth for slowly withdrawing the gaseous medium from the muffle in the vicinity of said hearth, and means for subjecting material being heat treated and said enveloping atmosphere to regulated heat.

CARL I. HAYES.