

May 6, 1952

N. W. HUCKESTEIN
HEAT-TREATING FURNACE

2,596,027

Filed Jan. 4, 1950

2 SHEETS—SHEET 1

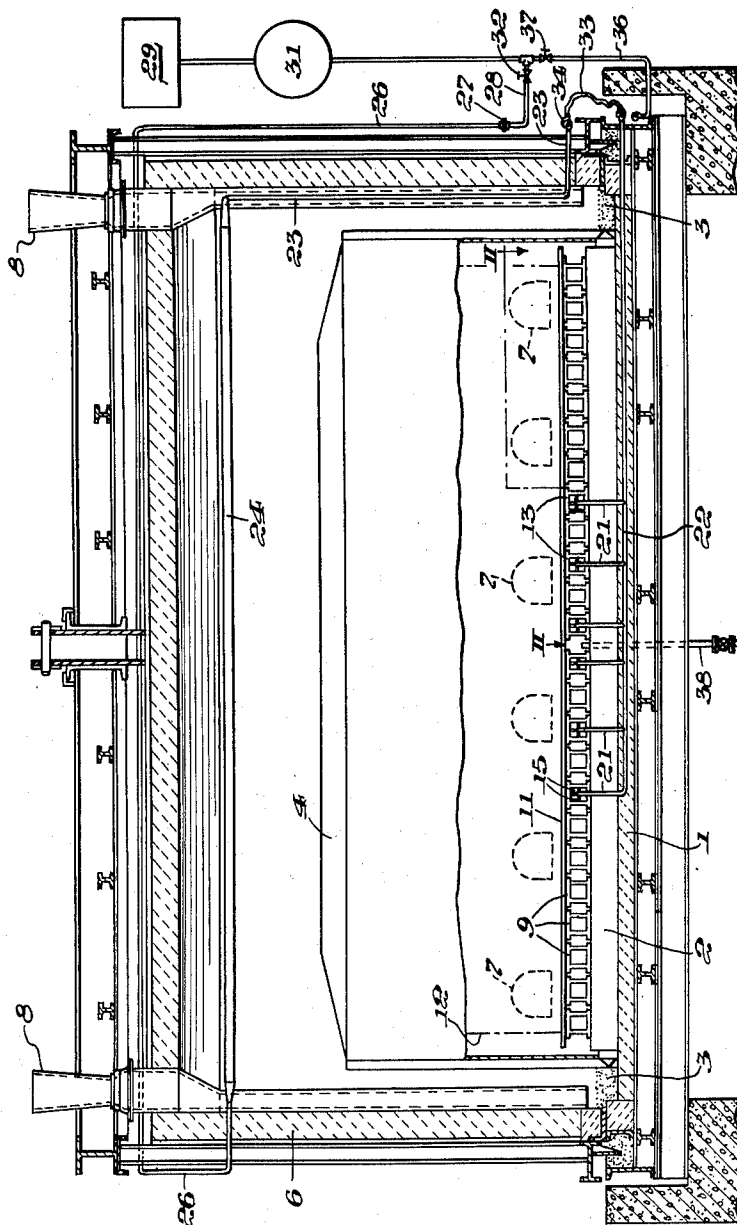


Fig. 1.

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2 SHEETS—SHEET 2

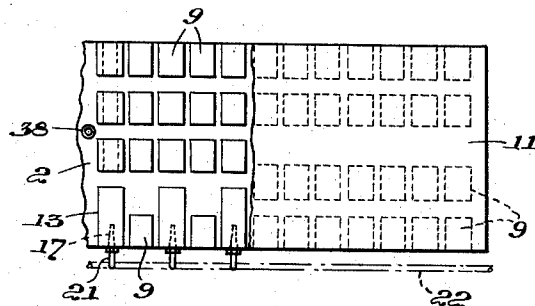


Fig. 2.

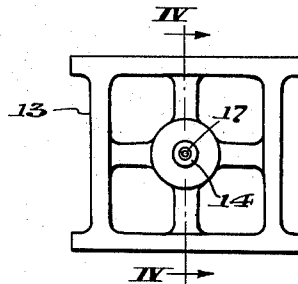


Fig. 3.

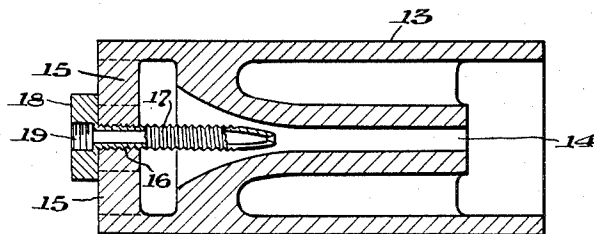


Fig. 4.

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HEAT-TREATING FURNACE

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2 Claims. (Cl. 263—40)

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This invention relates to heat treating furnaces, and more particularly to such furnaces provided with means for recirculating a prepared gas therein during the heat treating operation.

In the annealing of metal sheets, for example, it is customary to surround them with a prepared gas to control their metallurgical characteristics. In such cases the sheets are covered in the furnace by an inner hood into which the prepared gas is introduced. It has been proposed to circulate the gas inside the hood by electric fans, but fans are expensive and not very satisfactory.

It is among the objects of this invention to provide a heat treating furnace in which a prepared gas can be circulated around the objects being heat treated without the use of fans, in which the circulating means are simple and inexpensive in construction and cost nothing to operate and maintain, and in which the prepared gas can be preheated.

In accordance with this invention the furnace is provided with jet means having substantially parallel passages extending therethrough. These passages are of general Venturi shape with all of their inlets at the same end. Streams of gas under pressure are directed into the passages so that the streams will draw gas that already is in the furnace into the passage inlets for recirculating it in the furnace. Preferably, the jet means is in the form of a plurality of jet members, such as blocks, which may be set on the base of the furnace inside the inner hood. A base plate may rest on the blocks for supporting the metal to be heat treated in the furnace. A jet tube is mounted in the inlet end of each of the passages through the blocks and is spaced from the side wall thereof. Pipes are connected to the outer ends of the jet tubes and to a source of gas under pressure outside of the furnace. Consequently, as the streams of gas issue from the jet tubes they draw the gas surrounding the blocks into the passage inlets and cause it to flow across the furnace beneath the base plate, thus recirculating the gas around inside of the hood.

The side walls and roof of the furnace form an outer hood which is removable from the base. This hood supports inside of itself a gas preheater that is connected by an inlet pipe to the source of prepared gas. The outlet pipe from the preheater extends out of the hood and is detachably connected to the outer end of the pipe that leads into the jets. The outer hood can be removed after a joint in the inlet pipe

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has been opened and the outlet pipe has been disconnected from the jet pipe. To keep prepared gas circulating inside of the inner hood after the outer hood has been removed, the jet pipe is connected to the source of prepared gas after the other pipes have been disconnected.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which Fig. 1 is a longitudinal section through one side of the furnace with the lower part of the inner hood shown in section; Fig. 2 is a fragmentary horizontal section taken on the line II—II of Fig. 1; Fig. 3 is an enlarged view of the inner end of one of the jet blocks; and Fig. 4 is a vertical longitudinal section of the block taken on the line IV—IV of Fig. 3.

Referring to the drawings, the rectangular base 1 of the furnace has an inner elevated refractory base 2, around which there is a layer of sand 3 that forms a seal for the bottom of a removable inner hood 4 surrounding the elevated base to form a heat treating chamber. Resting on the base around the inner hood is the heavy refractory outer hood 6 which forms the furnace. The side walls of the outer hood are provided with burners 7 shown in dotted lines behind the inner hood, by which the temperature inside the furnace is raised to the desired point. The outer hood may be provided with eductors 8 for drawing out the products of combustion.

Mounted on the elevated base 2 are a plurality of hollow metal blocks 9 which are open at their opposite ends. These blocks preferably are placed in parallel rows with the openings therethrough extending transversely of the base. The blocks support a heavy metal plate 11 on which the articles to be heat treated are placed. For example, a pile 12 of metal sheets may rest on the base plate, as indicated in broken lines in Fig. 1.

It is a feature of this invention that a prepared gas is delivered continuously into the inner hood 4 and is used to recirculate the prepared gas with which the hood soon becomes filled. Accordingly, a few of the supporting blocks 9 are omitted to provide spaces for jet members 13. Each jet member is a block similar in appearance to the supporting blocks but may be a little longer. Each jet block has a central passage 14 of general Venturi shape extending through it. The larger or inlet end of the passage is spaced inwardly from the adjacent end of the block, and between that end of the block and the inlet a pair of cross members 15 integral with the block intersect at their centers. The intersection is provided with a threaded opening 16 in axial align-

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ment with passage 14. Screwed into this opening is a jet tube 17 which has at its outer end a hexagonal head 18. The head has a threaded axial opening 19 through it for connection to a branch pipe 21. The inner end of the tube extends into the throat of the Venturi passage, from the wall of which it is spaced, and it is tapered and provided with a flaring outlet.

The branch pipes 21 from the different jet tubes extend down past the elevated base 2 and into the main base 1 where they are connected to a horizontal gas pipe 22 that extends out of the furnace through one end of the base. To supply gas to this pipe while the furnace is in operation, its outer end is connected to the outer end of a pipe 23 that extends into the outer hood 6 and up to the outlet of a preheater 24 near the top of the hood. This preheater may be any suitable type of heat exchanger. The one shown extends lengthwise of the hood and has its inlet end connected to a pipe 26 that extends out of the opposite end of the hood and then back across the top of the hood and down the other end of the furnace. The lower end of inlet pipe 26 is connected by a coupling 27 to a supply pipe 28 that leads to a source 29 of prepared gas. The supply pipe may be provided with a booster 31 for increasing the pressure of the gas. Near coupling 27 the supply pipe also is provided with a valve 32.

The outer ends of the preheater outlet pipe 23 and the base pipe 22 are detachably connected together so that they can be separated, along with coupling 27, when it is desired to remove the outer hood from the base. This detachable connection may be made by an ordinary coupling, but it is preferred to connect the base pipe to the preheater outlet pipe by means of a flexible conduit 33 connected to the latter by a quickly detachable coupling 34. The reason for this is that after the outer hood has been removed it is highly desirable to keep the prepared gas circulating in the inner hood so that the metal sheets will cool more rapidly. Accordingly, when the flexible conduit is disconnected from the preheater pipe, after the valve 32 in the supply pipe has been closed, the conduit then is connected to the open end of a branch pipe 36 that is connected through a normally closed valve 37 to the supply pipe behind its valve. By opening the normally closed valve the prepared gas then will be delivered through the branch pipe and the flexible conduit to the base pipe without material interruption.

The prepared gas enters the inner hood through the jet tubes and jet blocks and gradually displaces the air in the hood by forcing it to leak out or by forcing it out of a valved outlet passage 38 extending through the base. The hood soon becomes filled with the prepared gas. Since the gas issues from the jet tubes at high velocity into the throats of the Venturi passages, the streams of gas draw the gas in the hood down one side of the pile of sheets and into the passage inlets and forces it out of their outlets. As all of the outlets face in the same direction, the result is that the gas in the hood is recirculated therein by being drawn down one side of the pile of sheets and then blown across the base beneath base plate 11 and up the other side of the pile. A continuous circulation of the prepared gas around the pile of sheets thus is maintained. During the heating operation this circulation transfers heat from the hotter inner hood to the pile of sheets more rapidly than if there were no circulation and thereby shortens the heating period. After the outer hood has been removed, the cir-

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culating gas in the inner hood hastens the cooling of the pile of sheets by transferring heat from the pile to the cooler inner hood. As a result of thus shortening the heating and cooling periods, the tonnage production of the furnace is increased and therefore the cost of the heat treating per ton is reduced. As the circulating means are of simple and sturdy construction and include no moving parts, they require no upkeep and no additional operating expense except what may be required to operate the booster.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A heat treating furnace comprising a base, a removable hood over the base, jet means resting on the base and provided with substantially parallel horizontal passages extending therethrough, said passages being of general Venturi shape with all of their inlets at the same end, a gas preheater supported by said hood inside of it, an inlet pipe connected to the preheater inlet and adapted to be detachably connected to a source of prepared gas under pressure outside of the furnace, an outlet pipe connected to the preheater outlet and extending out of the hood, a pipe supported by said base and extending out of the furnace, detachable means connecting the outer ends of said outlet pipe and base pipe together, means for directing streams of preheated gas from said base pipe into said Venturi passages, whereby said streams will draw gas that already is in the furnace into said passage inlets for recirculating it in the furnace, and means for connecting said base pipe to said source of gas when the base pipe and said outlet pipe are disconnected and the hood is removed from the base, so that gas will continue to be delivered to said jet means.

2. A heat treating furnace comprising a base, a removable hood over the base, jet means resting on the base and provided with substantially parallel horizontal passages extending therethrough, said passages being of general Venturi shape with all of their inlets at the same end, a gas preheater supported by said hood inside of it, an inlet pipe connected to the preheater inlet and adapted to be connected to a source of prepared gas under pressure outside of the furnace, a joint in the pipe for separating it to permit the hood to be lifted from the base, an outlet pipe connected to the preheater outlet and extending out of the hood, a pipe supported by said base and extending out of the furnace, detachable means connecting the outer ends of said outlet pipe and base pipe together when the hood is in place, means for directing streams of preheated gas from said base pipe into said Venturi passages, whereby said streams will draw gas that already is in the furnace into said passage inlets for recirculating it in the furnace, and a normally closed branch pipe connected to said inlet pipe behind said joint, said detachable means being adapted to connect said base pipe with the branch pipe after the base pipe and said outlet pipe are disconnected, so that gas can continue to be supplied to said jet means when the hood is removed from the base.

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