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APPARATUS FOR COOLING COKE

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2 Sheets-Sheet 1

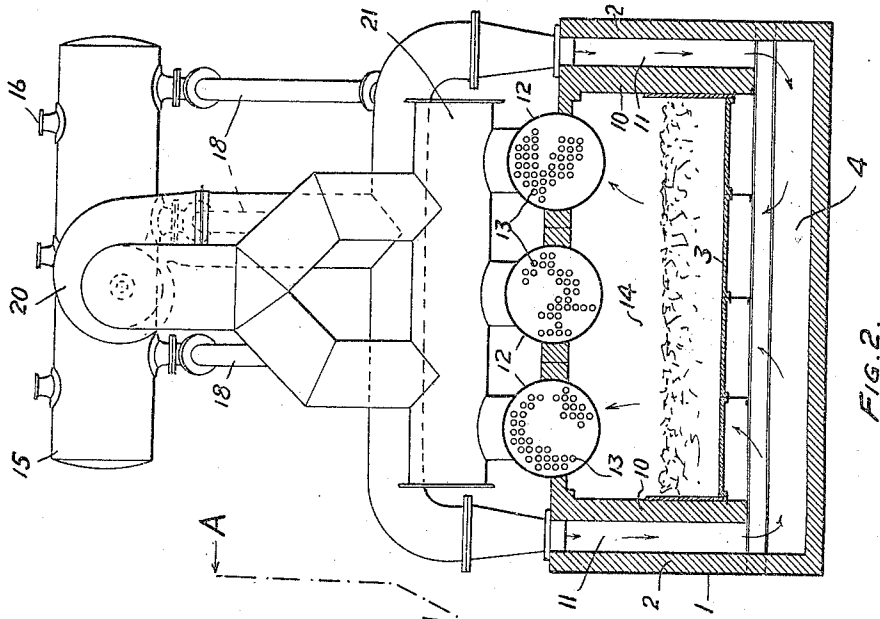


FIG. 2.

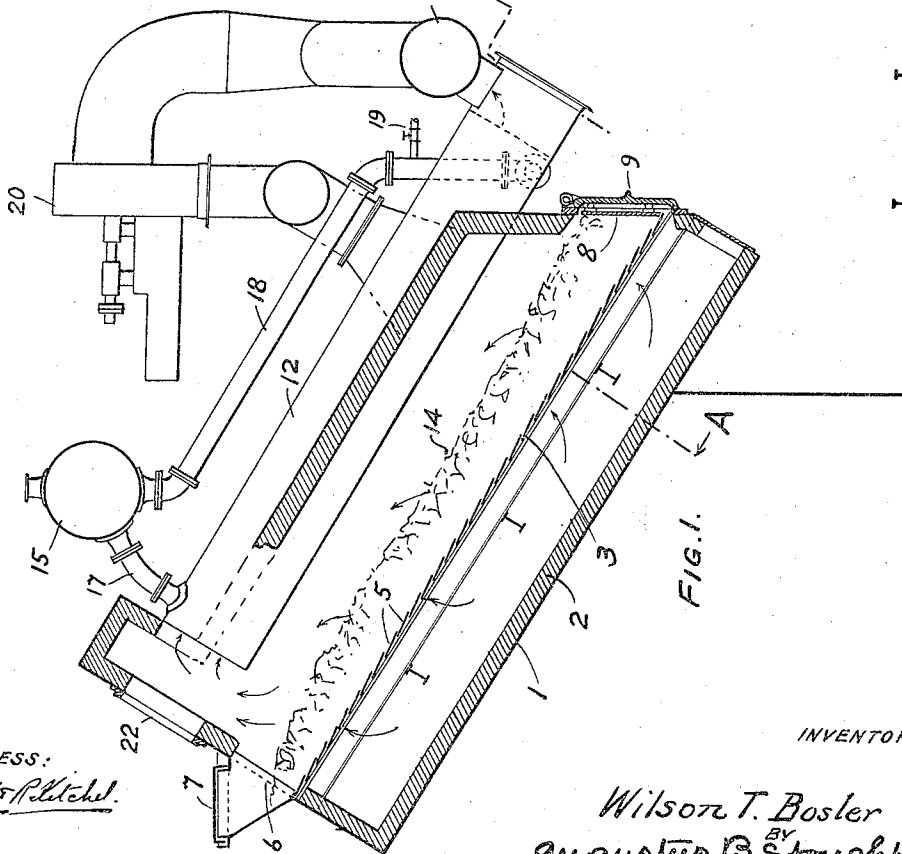


FIG. 1.

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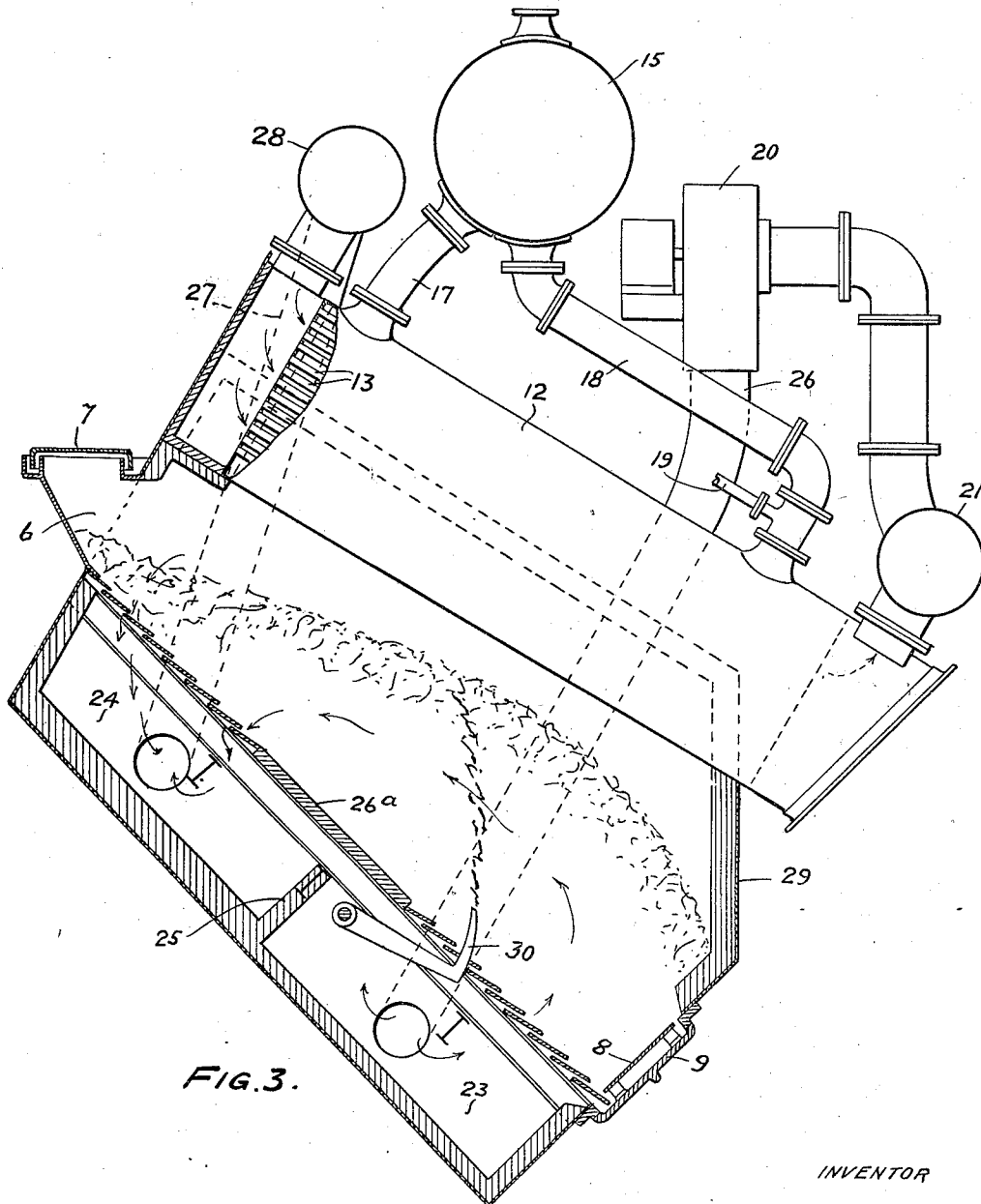
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2 Sheets-Sheet 2



WITNESS:

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UNITED STATES PATENT OFFICE

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APPARATUS FOR COOLING COKE

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The present invention relates to the cooling of hot coke from retorts or ovens with the recovery of a large part of its sensible heat.

The object of the invention is to provide improved apparatus for effecting such cooling.

The invention includes the provision of a casing enclosing an inclined perforated wharf to support the coke, a fire tube boiler or boilers inclined in the same direction as the wharf and partially or entirely enclosed within the casing, confronting the wharf and in direct heat radiating relation to the coke thereon, combined with means to circulate gas through the wharf, coke and the tubes of the boiler or boilers.

The invention also comprises the improvements to be presently described and finally claimed.

The invention will be further described and its advantages pointed out in connection with the accompanying drawings forming a part of this specification, and in which

Figure 1 is a vertical longitudinal cross section of a form of the apparatus chosen for illustration.

Fig. 2 is a transverse vertical cross section along the line A—A in Fig. 1, and

Fig. 3 shows a vertical longitudinal cross section of a modified form of the apparatus of the invention.

Referring to Figs. 1 and 2, 1 generally indicates a closed casing provided with the refractory and heat insulating lining 2, and enclosing the inclined, perforated wharf 3, which is positioned above the bottom of the casing so as to provide the space or chamber 4 beneath the wharf.

The wharf is preferably made up of the under lapping plates 5, having interstices between them forming passages leading from the space below the wharf to that above.

The casing is provided with the charging opening 6 at the high end of the wharf, and its gas tight closure 7, which in the apparatus shown is water sealed. The casing is also provided with the discharge opening 8 at the low end of the wharf, provided with the gas tight door or gate 9.

The partitions 10 are provided within the

casing, extending from the sides of the wharf to the top of the casing and providing the flues 11, between the partitions and the casing. These flues communicate with the chamber 4 below the wharf.

The fire tube boiler or boilers are preferably, only partially enclosed within the casing and are shown thus in the apparatus chosen for illustration, which indicates three fire tube boilers 12, their fire tubes 13 communicating with the space 14 above the wharf and between the partitions. The boilers are provided with the steam drum 15 and the necessary steam offtakes 16, as well as the water circulating connections 17 and 18 and the feed water inlet 19.

A fan 20 is provided, the inlet side of which is connected to the fire tubes of the boilers, as shown through the header 21. The pressure side is connected to the flues 11 within the casing.

Doors as 22 are provided to allow access to the boilers for cleaning or for removing and replacing tubes or other repairs. The boiler shell and the wharf are inclined in the same direction with respect to the horizontal and in confronting relation.

In operation, a charge of hot coke is admitted through the opening 6, the door 9 being closed. The angle of inclination of the wharf is such that the coke slides down over it gently without breakage and the charge distributes itself in a quiescent layer over the wharf. The opening 6 is closed and the air within the apparatus is circulated and recirculated by the fan, through the wharf, coke and boiler. After one or two passages through the coke the air is spent by combustion of a small amount of coke and the further circulation is of these products which are inert to the coke.

During the passage of the gas through the coke, it becomes heated thereby cooling the coke, and during its passage through the boiler it becomes cooled, giving up its heat, through the boiler tubes to the water to raise steam. The recirculation is carried on until the coke has reached the desired lower temperature for discharge. The coke is also cooled at the same time by direct radiation to

the bottom portions of the shells of the boilers which form large heat absorbing surfaces in heat radiating relation to the coke.

The combination of the cooling by the forced recirculation of the gas, and the cooling by direct radiation, results in a very short time being necessary for the cooling operation and a large capacity for the apparatus.

When the coke has been cooled to the desired lower temperature, the circulation of gas is terminated, the door 9 is opened and the batch of coke slides gently down off the wharf and out of the apparatus.

The fire tube boilers may be of standard type which can be manufactured economically. Moreover, they can be made in the shop and shipped assembled, which reduces the necessary construction in the field.

The apparatus is compact and simple, economical of construction, efficient in operation and of high capacity.

It combines the more economical construction of the fire tube boiler, with the high rate of cooling secured by combined recirculation of gas and direct radiation, and includes the gentle handling of the coke and low breeze production inherent in the wharf type cooler.

The construction and mode of operation of the modification illustrated in Fig. 3 are as has been described in connection with Figs. 1 and 2 except that the chamber below the wharf is subdivided into two portions 23 and 24 by a partition 25 above which the wharf is provided with an imperforate intermediate portion 26^a. The subdivision 23 of the chamber is connected with the fan by external connections 26, and the subdivision 24 of the chamber is connected with the fire tubes of the boiler by an external connection 27 and a header 28. At its discharge end the coke chamber is somewhat enlarged as by the provision of the wall 29. There are also provided finger gates 30 which are rake-shaped structures having spaced upwardly projecting teeth.

In use, assuming the wharf to be fully charged with coke, inert gas is circulated upward through the righthand portion and downward through the lefthand portion. When the righthand portion is sufficiently cool, the finger gates are turned into the position shown and the righthand portion discharged, then the lefthand portion is permitted to move toward the right by turning down the gates and a new batch of hot coke is introduced at the lefthand end. The object of this is to maintain a uniform and continuous generation of steam.

It will be obvious to those skilled in the art to which the invention relates that modifications may be made in details of construction and arrangement and matters of mere form without departing from the spirit of the invention which is not limited to such

matters or otherwise than the prior art and the appended claims may require.

I claim:

1. Apparatus for cooling coke comprising a closed casing, a fire tube boiler, an inclined foraminous coke wharf, said wharf forming a lower wall of said casing, a portion of the shell of said boiler being arranged in the casing in spaced, uninterrupted confronting relation to said wharf and above the same and inclined in a similar direction to the horizontal, means for providing and maintaining hot coke in batches quiescent upon said wharf and beneath said shell, two chambers provided beneath the foraminous wharf both of said chambers separately and directly communicating with the closed casing through said wharf, a gas conduit from one of said chambers to one of the ends of the fire tubes of the boiler, a fan for circulating inert gas, a second gas conduit connected with the fan and with the other of said chambers, and a third gas conduit connected with the fan and with the other ends of the fire tubes of the boiler.

2. Apparatus for cooling coke comprising a closed casing, a fire tube boiler, an inclined foraminous wharf having an intermediate imperforate portion, said wharf lying within said casing and spaced from a lower wall of said casing, a portion of the shell of said boiler being arranged in the casing in spaced confronting relation to said wharf and above the same and inclined in a similar direction with respect to the horizontal, said casing having a charging opening and a discharging opening therein at the ends of said wharf, doors in said charging opening and in said discharging opening at the ends of said wharf, a gate intermediate of the ends of the wharf for providing and maintaining hot coke in batches quiescent upon said wharf and beneath said shell, said imperforate portion extending across said wharf transversely of the same, a partition in the space between said wharf and said lower wall which extends beneath and transversely of said wharf thereby dividing said space into two chambers which communicate separately and directly with a part of said casing thereabove through said wharf, a gas conduit connecting one of said chambers and one of the ends of the fire tubes, a fan having connection through a second gas conduit with the other ends of said fire tubes and a third gas conduit from the fan to the other chamber.

3. Apparatus for cooling coke comprising a closed casing, a fire tube boiler, an inclined foraminous wharf having an intermediate imperforate portion, said wharf lying within said casing and spaced from a lower wall of said casing, the shell of said boiler being mounted in the upper wall of said casing so as to project into and out of said casing, said wharf and said shell being arranged in

spaced confronting relation and inclined in a similar direction with respect to the horizontal, said casing having a charging opening and a discharging opening therein at the ends of said wharf, doors in said charging opening and in said discharging opening respectively at the ends of said wharf, a finger gate intermediate of the ends of the wharf for providing and maintaining hot coke in batches quiescent upon said wharf and beneath said shell, said imperforate portion extending across said wharf transversely of the same, two chambers provided in the space between said wharf and said lower wall at the opposite ends of said wharf respectively, said chambers having a partition in common which extends beneath said imperforate portion and transversely of said wharf, said chambers communicating separately and directly with a part of said casing thereabove through said wharf, a gas conduit connecting one of said chambers and one of the ends of the fire tubes, a fan having connection through a second gas conduit with the other ends of said fire tubes, and a third gas conduit from the fan to the other chamber.

4. An apparatus for cooling coke including a closed casing; an inclined, perforated wharf within said casing; means for admitting hot coke to the upper end of said wharf and for removing relatively cooler coke from the lower end of said wharf; a fire tube boiler a portion of whose shell is in said casing in spaced, confronting relation to said wharf and above the same and inclined in a similar direction as said wharf and adapted to receive heat by radiation from coke on said wharf; a chamber within said casing beneath said wharf; and means for circulating gas through said chamber, through said wharf and coke thereon, and through said fire tube boiler.

5. An apparatus for cooling coke including a closed casing; an inclined perforated wharf within said casing; means for admitting hot coke to the upper end of said wharf and for removing relatively cooler coke from the lower end of said wharf; a fire tube boiler a portion of whose shell is in said casing in spaced, confronting relation to said wharf and above the same and inclined in a similar direction as said wharf and adapted to receive heat by radiation from coke on said wharf; a chamber within said casing beneath said wharf communicating directly with a part of said casing thereabove through said wharf; means for conducting gas from a part of said casing above said wharf at one end of said wharf to one of the ends of the fire tubes of said boiler; a fan for circulating gas; a second gas conduit connected with said fan and with said chamber; and a third gas conduit connected with said fan and with the other end of the fire tubes of the boiler.

6. Apparatus for cooling coke comprising

a closed casing; a fire tube boiler; an inclined foraminous wharf; said wharf being within but spaced from the lower walls of said casing and having ends in contact with the side walls of said casing; a portion of the shell of said boiler being arranged in the casing in spaced confronting relation to said wharf and above the same and inclined in a similar direction with respect to the horizontal and adapted to receive heat by radiation from coke on said wharf, said casing having a charging opening and a discharging opening therein at the ends of said wharf, doors in said charging opening and in said discharging opening at the ends of said wharf, a gate intermediate the ends of the wharf for providing and maintaining hot coke in batches quiescent upon said wharf and beneath said shell, two chambers provided beneath the wharf at the opposite ends thereof respectively, said chambers being within said casing and having a partition in common which extends beneath and transversely of said wharf; said chambers communicating separately and directly with a part of said casing thereabove through said wharf; a gas conduit connecting one of said chambers and one of the ends of the fire tubes, a fan having connection through a second gas conduit with the other ends of said fire tubes, and a third gas conduit from said fan to the other chamber.

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