

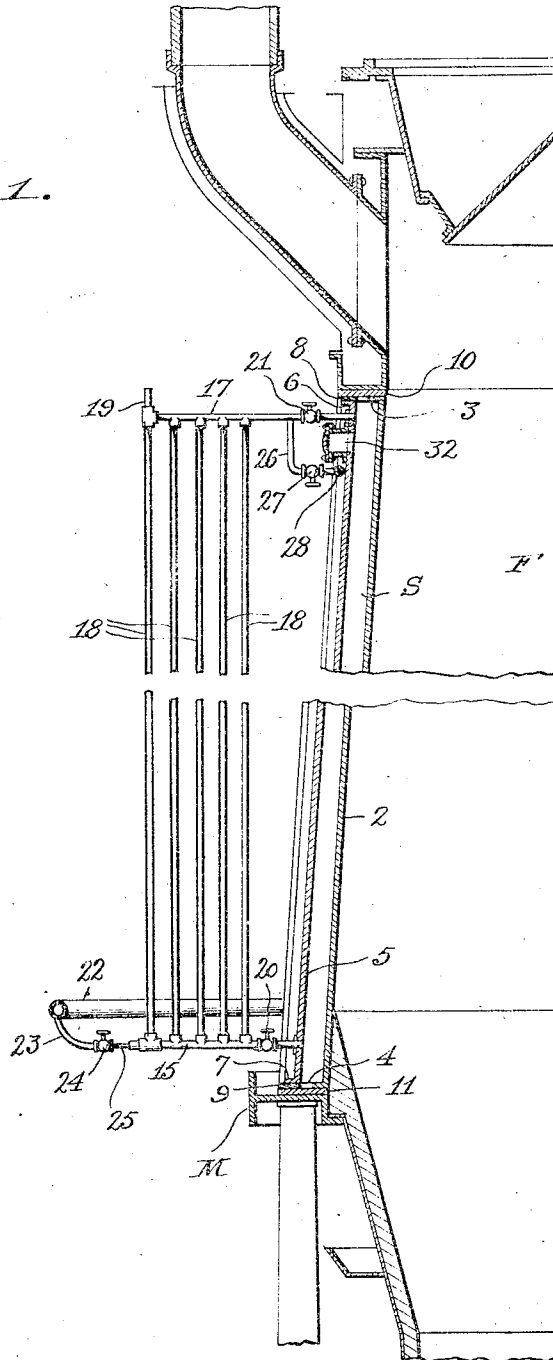
F. D. CARNEY.
BLAST FURNACE COOLING DEVICE.
APPLICATION FILED JUNE 15, 1912.

1,042,767.

Patented Oct. 29, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

B. Rommers
E. Leckert.

By

Henry Orth

Attorney

Inventor
Frank D. Carney

F. D. CARNEY.
BLAST FURNACE COOLING DEVICE.
APPLICATION FILED JUNE 15, 1912.

1,042,767.

Patented Oct. 29, 1912.

2 SHEETS—SHEET 2.

Fig. 2.

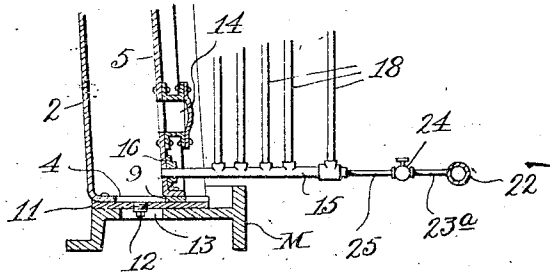


Fig. 3.

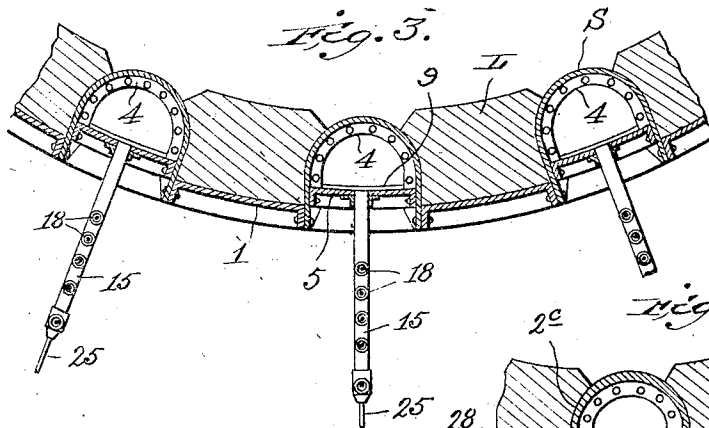


Fig. 7.

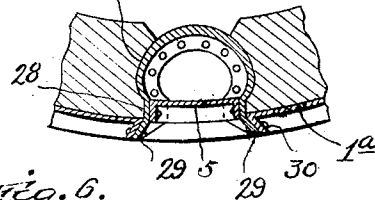


Fig. 4.

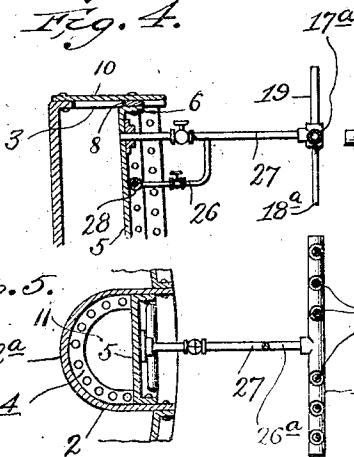


Fig. 6.

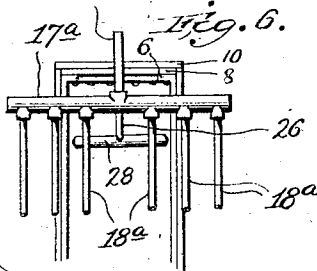
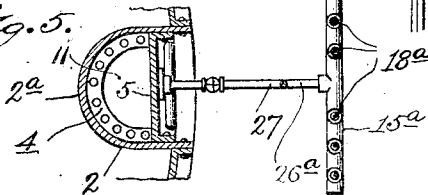


Fig. 5.



Inventor

Frank D. Carney

Witnesses

M. Kommers

C. Leckert.

By

Henry Orth

Attorney

UNITED STATES PATENT OFFICE.

FRANK D. CARNEY, OF STEELTON, PENNSYLVANIA.

BLAST-FURNACE-COOLING DEVICE.

1,042,767.

Specification of Letters Patent.

Patented Oct. 29, 1912.

Application filed June 15, 1912. Serial No. 703,909.

To all whom it may concern:

Be it known that I, FRANK D. CARNEY, a citizen of the United States of America, residing at Steelton, Dauphin county, Pennsylvania, United States of America, have invented certain new and useful Improvements in Blast-Furnace-Cooling Devices; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to blast furnace construction, and more particularly to a structure permitting the walls of the furnace to be maintained cool during its operation, thereby enabling a reduction of the thickness of the lining, decreasing the wear on the lining, facilitating the re-lining of the furnace, and generally prolonging the life of the furnace. This I do by using hollow cooling staves extending substantially the length of the furnace and supported on the mantle. These staves are spaced apart, and the intervals filled with the customary fire brick; while outside of the brick the staves are connected to one another by shell plates, which, together with the staves form the shell of the furnace. In addition the staves are each provided outside the furnace with circulating and cooling pipes, as will hereinafter be explained in detail.

Referring to the drawings in which like parts are similarly designated—Figure 1 is a vertical sectional view of a portion of a blast furnace showing my invention applied thereto. Fig. 2 is a detail view, partly in section, of the mantle and lower part of a stave. Fig. 3 is a horizontal section on an enlarged scale showing the staves and sections of the furnace shell alternating. Figs. 4, 5 and 6 are, respectively, fragmentary vertical and horizontal sections and front elevation of a modified form of radiator arrangement. Fig. 7 is a section showing a modified form of shell.

Referring to Fig. 1, F represents a blast furnace whose walls are composed of long hollow, water-cooled staves S alternating with fire brick lining L, (Fig. 3). The staves are connected with one another by furnace shell plates 1, which, together with adjacent staves support the fire brick.

As shown in Figs. 1 and 2, the staves rest on the mantle M of the furnace. The staves are made of long plates 2, bent substantially U-shaped in section, the bending being done preferably after the final rolling operation at the rolling mill. These plates are 50–60 feet long, more or less, depending upon the height of the furnace. Their ends are turned up to form top and bottom flanges 3 and 4. Across the trough are riveted channels 5, also having top and bottom flanges 6 and 7 respectively. Between the ends of the top and bottom flanges 3 and 4 are placed filling pieces 8 and 9, respectively, which are of the same thickness as said flanges and against which lie the top and bottom flanges 6 and 7 of the channels. The stave is then closed by end plates 10 and 11 to form a water-tight compartment by riveting the parts together. The bottom end plate 11 is provided with a drainage hole closed by a screw plug 12, access to which plug is gained through an inspection opening 13 in the mantle M. In the lower part of each stave in the channel member 5 is provided a covered hand-hole 14 for removing scale and sludge. Projecting from the lower end of each channel is a manifold pipe 15, and in order to secure a tight and strong connection of the end of the manifold pipe 15 in the channel member 5, there is welded in the channel member a plate or washer 16 into which the end of the manifold screws. A similar manifold pipe 17 is similarly connected to the upper end of the channel member 5, and the side openings in the manifold are connected by circulating pipes 18. One of the pipes 18, preferably the outermost one, has an extension 19 to a greater or less extent above the upper manifold pipe and is left open. Each manifold pipe is provided with a cut-off valve, 20, 21, respectively, located adjacent the channel member 5, that is to say, between the point of connection of the innermost pipe 18 with the manifold and its channel member. Surrounding the furnace, preferably slightly above the mantle, is a bustle water supply pipe 22. This pipe is connected by short supply pipes 23 to the lower manifold 15 for each stave. The pipe 23 contains a valve, 24, and a short pipe 25 of smaller diameter than the manifold projects a short distance into the same and acts as an injector. The pipe 23 may be of the same size as the pipe 25, as shown at 23^a, Fig. 2. Con-

connected to the upper manifold is a pipe 26 containing a valve and terminating in a spray pipe 28 substantially parallel to the face of the channel 5. It will be noted that the channels 5 forming the backs of the water staves are set forward toward the interior of the furnace with respect to the channels 1 forming the intermediate shell sections. This facilitates the riveting of the channels 1 to the staves, as in this case the rivets do not have to pass through the flanges of the channels 5.

In Figs. 1-3 I have shown the pipes 18 and manifolds as located in a plane substantially radial of the furnace.

In Figs. 4-6 I have shown the manifolds 15^a and 17^a and the pipes 18^a substantially parallel to the channel 5, or in a vertical plane at right angles to the plane in which the similar elements are located in Figs. 1-3. The manifolds are connected to the staves by pipes 26^a and 27. In these figures I have shown the plate from which the trough 2 is made thicker at 2^a that portion being directly exposed to the descending charge in the furnace.

In Fig. 7 I have shown a stave of modified cross section, the trough 2 being bent inwardly at 28, thus using a narrower channel 5. The trough member 2 is then bent outwardly to form diverging flanges 29, by which the staves are connected to converging flanges 30 of the shell members 1^a. This form of section produces a better interlock with the masonry.

The operation is as follows: The spray pipe valve 27 of a stave being closed all other valves to a stave are opened and the stave and pipes filled with water from the bustle water pipe 22 until it flows out of the overflow 19. The heat being greatest at the lower part of the stave the hot water rises, passes along the upper manifold 17, down the pipes 18 to the lower manifold where the circulation is accelerated by the injector action of pipe 25, the excess of water spilling over the end of pipe 19. It will thus be seen that the two manifolds and their intermediate pipes form a radiator for dissipating the heat taken up by the water while in the stave. It is of course understood that the speed of circulation may be increased by loading the circulating system, either by means of an additional hydraulic head by extending the pipe 19 several feet above the upper manifold, or by a loading valve. The water spilling over the end of pipe 19 passes over the pipe on the outside, and its evaporation assists in cooling the water in the pipe. It will be observed that there are no rivets exposed to the inside of the furnace. Should a stave develop a leak or crack, its water system is cut off by closing valves 20 and 21. The stave is drained through its plug 12 and is filled with ganister mud,

either by disconnecting the upper manifold and introducing the mud through the pipe socket, or it may be introduced through a special opening 32, Fig. 1. Valve 27 is then opened and water sprayed over the face of channel 5 by the spray pipe 28, and the line of the furnace thus held. The front of the stave inside the furnace then burns off, and the ganister mud forms a protective lining.

I claim—

1. A blast furnace cooling stave, comprising a trough-shaped member, a channel member united to the trough-shaped member between its sides, end plates connected to the channel and trough-shaped members and means to cause a circulation of water through the stave.

2. A blast furnace cooling stave, comprising a trough-shaped member, a member extending across the trough, end members closing the ends of the chambers formed by the two members, and means to produce a circulation of cooling water through the stave.

3. A blast furnace cooling device comprising a hollow stave and a circulating and radiating system connected to the stave to cause circulation through the system and stave.

4. A blast furnace cooling device, comprising a hollow stave, a circulating and radiating pipe system connected to the stave and having an overflow above the stave, and means to inject water into the lower part of said system to assist the circulation of water in the system and stave.

5. A blast furnace cooling device, comprising a hollow stave, a water circulating and radiating pipe system connected to the stave, valves to disconnect the system from its stave, and a water spraying pipe connected to the system arranged to deliver a water spray to the outer surface of the stave near its top.

6. The combination with a blast furnace, of hollow water-cooled staves, furnace shell members connected to and between adjacent staves, a bustle water supply pipe, a radiating and circulating system connected to each stave and having connection with said bustle pipe.

7. The combination with the mantle of a blast furnace, of hollow, water-cooled staves supported by said mantle, channel-shaped shell members between and connected to adjacent staves, fire brick lining between the staves, a water bustle pipe, a circulating and radiating water system connected to each stave and the bustle pipe, and means to maintain a pressure on the water in said system.

8. A hollow water-cooled stave comprising trough-shaped members whose walls exposed to the charge of the furnace are thickened, a channel member connected between

the sides of the trough-shaped member, the edges of said trough-shaped member projecting beyond the flanges of the channel member, and a furnace shell member secured to said projecting sides of the trough-shaped member and means closing the ends of the stave.

9. A hollow water-cooled stave comprising a trough member thickened at its longitudinal center, a channel connected to and between the sides of the member, means for closing the ends of the stave so formed, an

upper manifold, a lower manifold, radiator pipes connected between the manifolds and means to supply water to the lower manifold.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

FRANK D. CARNEY.

Witnesses:

GEO. W. PARSONS,
CHARLES P. TURNER.