March 22, 1966 W. E. LOECHER 3,241,528

BLAST FURNACE COOLING PLATES

Filed June 13, 1963

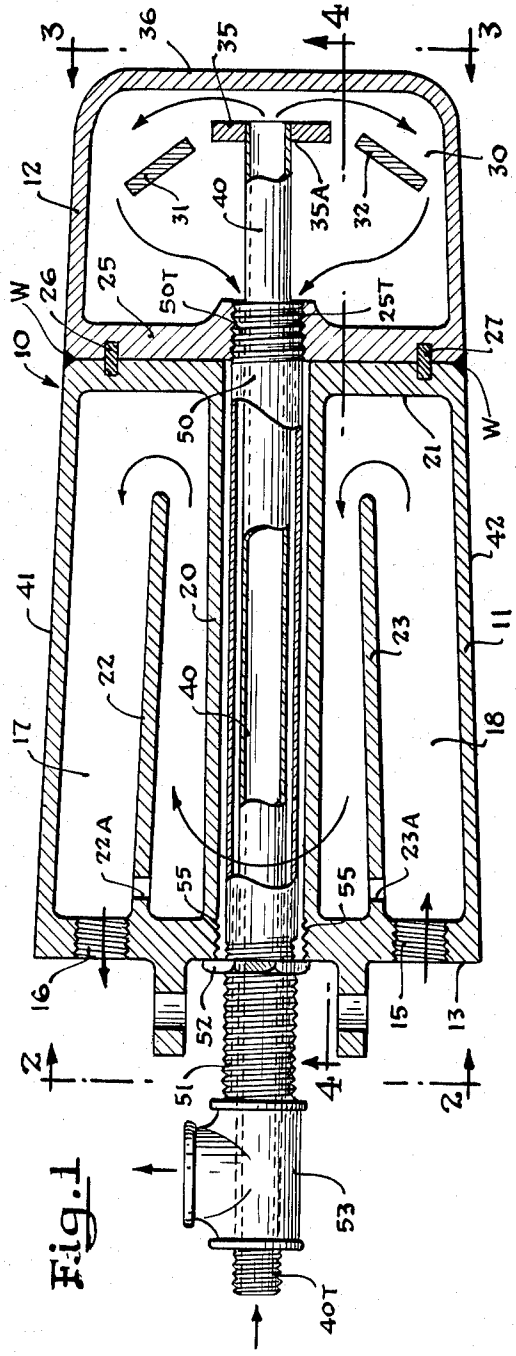


Fig. 1

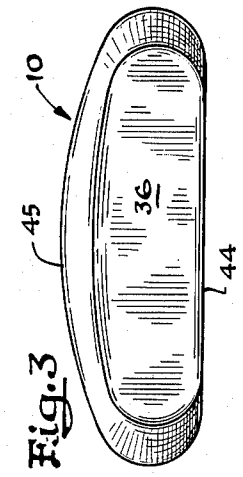


Fig. 3

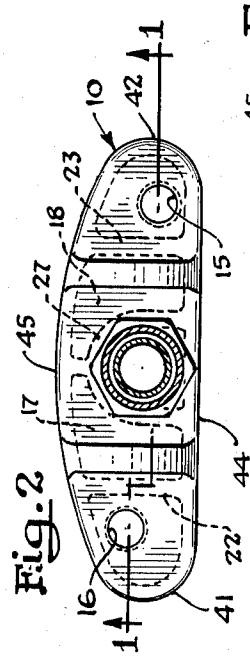


Fig. 2

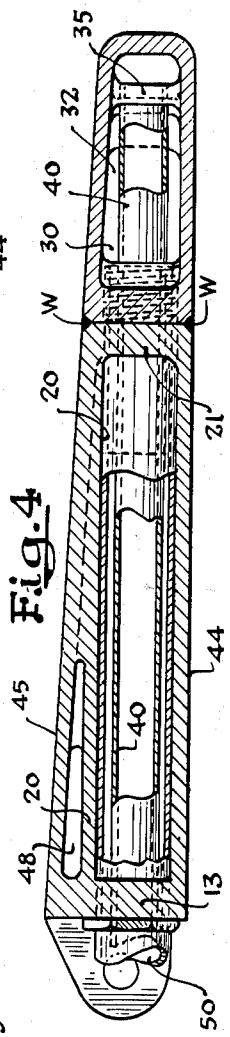


Fig. 4

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BLAST FURNACE COOLING PLATES

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7 Claims. (Cl. 122—6.5)

This application is a continuation-in-part of my application Serial No. 232,064 filed October 22, 1962, now abandoned.

This invention relates to a two-piece blast furnace cooling plate. In particular, the invention relates to a plate of the aforesaid kind having a complicated contour which presents restrictive limitations in regard to the size of conduits employed for achieving internal cooling of the nose and body portions thereof.

Wall sections of a blast furnace are oftentimes equipped with cooling plates designed for circulation of cooling water therein incidental to cooling and thereby prolonging the corresponding part of the furnace wall. The cooling plates are sometimes of quite complicated form presenting a substantial problem in any attempt to achieve an efficient circulation of cooling water within the plate. Thus, in the present instance, involving a two-piece plate characterized by separable body and nose members, a problem is presented by a contour within the body member presenting narrow sections which makes it difficult to achieve a maximum flow of cooling water to and from the nose of the plate.

The primary object of the present invention is to overcome this difficulty by directing coolant for cooling the nose portion through a conduit located at the maximum width of the body member, permitting a supply conduit of maximum diameter to be used, and surrounding this conduit with a concentric return conduit in communication with the nose of the plate. Additionally, the two pipes aforesaid are arranged within a tube cast integral with the body member of the plate to extend from the front to the rear wall thereof, this tube serving to impart strength to the plate as well as functioning as a vertical baffle, thereby increasing the turbulence and the efficiency of cooling water separately admitted to the interior of the body member as will be explained.

Cooling plates of the kind under consideration are subjected to rather severe mechanical abuse as the refractory wall portion of the blast furnace in which the plate is installed wears away, exposing the nose of the plate. In other words, after prolonged use of the furnace, the wall in which the cooling plate is installed gradually wears away, exposing more and more of the cooling plate to the burden of the furnace. Heretofore, this condition has resulted in rather severe warpage of blast furnace cooling plates, and in particular has caused early failure of the nose member of the plate. Downward warpage of the nose section causes the plate to creep into the furnace thereby creating a maintenance problem in removal. An additional problem is presented when attempting to shove the plate into the furnace (if removal is not successful) due to the wedge shape or complicated contour of the plate.

Under and in accordance with the present invention, the nose member is secured to the forward end of the body member of the plate by threadedly connecting thereto the aforementioned discharge pipe, enabling the nose portion to be easily dropped into the furnace thereby allowing the body portion to continue its function of cooling the remaining refractory of the blast furnace wall. The aforementioned tube cast integral with the body member may then be filled with a castable refractory and a pipe plug screwed into this chamber at the rear wall of the body member, thus sealing off any escaping furnace gases. The body alone will continue to function until such a time when a replacement cooling plate can be installed. At that time the body portion can be removed, inspected and if in satisfactory condition, a new nose and pipe assembly can be made.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

FIG. 1 is a sectional view of the cooling plate of the present invention, taken substantially on the line 1—1 of FIG. 2, and on an enlarged scale in comparison thereto;

FIGS. 2 and 3 are end elevations of the cooling plate on the lines 2—2 and 3—3 of FIG. 1; and

FIG. 4 is a sectional view substantially on the line 4—4 of FIG. 1.

As noted above, the blast furnace cooling plate of the present invention is of two-piece construction, and such is indicated by the reference character **10** in the drawings as inclusive of a blade-like compartmented or hollow body member **11** and a separate hollow nose member **12** that displays a taper complemental to that of the body member hereinafter described. Both members are cast.

The body member **11** includes a rear wall or butt end **13** provided with threaded openings **15** and **16** which enable water feed and discharge pipes to be coupled thereto for directing cooling water into the interior of the body member, and discharging the same. In this connection, it may be observed that the body member **11** includes two spaced side compartments **17** and **18** generally separated by a central tubular wall **20** cast integral with the body member to extend continuously from the front wall **21** of the body **11** to the rear wall **13**.

Additionally, the two compartments **17** and **18** are provided with flat vertical baffle plates **22** and **23**, FIG. 2, which project from the internal butt end of the body portion **11**, terminating short of the front wall **21**. Both baffle plates are cast as webs integrally joined internally to the top and bottom walls of the body member, hereinafter identified, although vent openings **22A** and **23A** are preferably provided therein for efficiency in turbulence.

The nose number **12** includes a rear wall **25**. The external surface thereof is planar and adapted to be butted against the planar external surface of the front end wall **21** of the body member **11**. A pair of locating pins **26** and **27** project from one of the butted walls to enable the other to be neatly fitted thereto incidental to facilitating the conduit connections hereinafter described.

The nose member includes a relatively large internal chamber **30** having a pair of upper and lower baffle plates **31** and **32** cast integral therein and joined to the internal side walls thereof as shown in FIG. 4. A conduit support **35** is also located within the nose portion just rearwardly of the front wall **36** thereof, and this support is provided with an aperture **35A** for supporting the forwardmost end of a feed or supply conduit **40** as hereinafter described in more detail.

It will be observed that the body member **11** (see FIG. 1) embodies a back-to-front taper that is of a convergent nature proceeding from the butt or rear wall **13** toward

the more narrow front wall 21. The contour is further complicated by the fact that the two side walls 41 and 42 are rounded; and of the top and bottom walls, the bottom wall 44 is flat or straight and the top wall 45 is arcuate.

Inasmuch as the walls of the body member 11 are of uniform thickness, this contour is also displayed at the inside of the cooling plate resulting in a differential or variant internal width making it rather difficult to achieve conduit sizes that permit enough flow of coolant to properly cool the interior of the separate nose member 12 simultaneously with the interior of the body member.

It will thus be seen that the interior of the body of the cooling plate includes sections of a rather confining nature, but in spite of this, and by locating the openings 15 and 16 as they are, it is possible to direct cooling water at a maximum rate and volume into the interior of the nose member by having resort to the supply pipe 40 located concentrically within a water return pipe which is located concentrically within the tubular wall 20 of the body portion as hereinafter described.

Thus, in supplying cooling water to the nose member 12 of the cooling plate 10, the feed pipe 40 is arranged in spaced relation within a return pipe 50 which in turn is arranged in spaced relation within the central tubular wall 20 of the body 11. The forwardmost end of the pipe 40 is supported by the element 35 mentioned above. In this connection it is to be observed that the support 35 is just rearward of the internal surface of the nose end wall 36 so that the inlet coolant is first directed against the end wall 36 which is subjected to the most severe thermal abuse. The pipe 40 extends outward of the body 11 and has a threaded end 40T adapted to be coupled to the supply of cooling water.

In connection with the admission of cooling fluid, it is important to note that the tube 20 is in part defined by the bottom wall 44, but is spaced in part from the top wall 45, adjacent the butt end of the plate, as shown in FIG. 4. Such spacing affords a chamber or cross-over gap 48 connecting chambers 17 and 18. The area of the gap 48 is in excess of the areas of the water input and output pipes, thereby to prevent restrictive water flow.

Under and in accordance with the present invention the nose 12 is securely joined to the body 11 by means including the threaded end 50T of the water discharge pipe 50, which is adapted to conduct the expired coolant from the compartment 30 of the nose 12. Thus, the rear end wall 25 of the nose 12 is provided with a tapped opening 25T in which the threaded end 50T of the return pipe 50 is located. Such a threaded joint as the sole effective connection between the body member 11 and the nose member 12 is adequate for most installations. However, where severe mechanical abuse is to be expected, additional strength may be afforded by a metallurgical bond in the form of a weld W between the butted ends of the body and nose as shown in FIGS. 1 and 4. Alternatively, a braze joint may be used as the metallurgical bond.

The discharge pipe 50 includes a threaded end 51 extending rearward from the end wall 13 of the body 11. A lock nut 52 is mounted on the threaded end 51 of the pipe 50 and is turned up thereon forcefully against the outer face of the butt end 13 of the body member 11. A T-fitting 53 is seated on the exposed end of the pipe 50 incidental to connecting the discharge pipe 50 to the drain.

In operation, copious amounts of cooling water are directed into the internal compartment 30 of the nose 12, emitted from the open end of the pipe 40. Turbulence within the compartment 30 is established by the baffles 31, 32 and support 35, and used coolant is discharged through the discharge pipe 50. Selection of the largest conduit, which permits maximum flow, is made possible by locating the feed pipe 40 at the widest portion of the body 11 as described above.

Likewise, large amounts of cooling water are separately

directed into the compartments 17 and 18 of the body 11, and the baffles 22 and 23, in cooperation with the central tubular wall baffle 20, produce turbulence at maximum efficiency for a casting of the kind under consideration.

It will therefore be seen that the tubular wall 20 of the body 11, located centrally within the body member at the widest part thereof, not only establishes maximum clearance for the supply and discharge conduits for nose coolant, but also cooperates with the baffles 22 and 23 to create maximum turbulence within the body 11. At the same time, the arrangement makes possible joining of the nose 12 to the body 11 by the thread 50T on the conduit 50 and the lock nut 52, with or without the supplementary metallurgical bond as may be needed for additional strength.

It will be noted, as shown in FIG. 1, that the butt end of the tubular casting 20 is threaded at 55. The reason for this is as follows. If the nose 12 drops into the furnace, there is no longer any use for the pipes 40–50. The latter are withdrawn, and a pipe plug is then seated in the threaded opening 55 to seal off the escape of furnace gas down the tube 20. A castable refractory can, if desired, be rammed into the tube 20 prior to installing the pipe plug.

Hence, while I have illustrated and described a preferred embodiment of my invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A blast furnace cooling plate comprising a blade-like hollow body member having a rear wall and a front wall, a separate hollow nose member having a forwardmost front wall and a rear wall abutting the front wall of the body member, said body member having an internal contour establishing an internal chamber of differential width, said body member being provided with an internal tube continuous between the front and rear walls and located substantially at the maximum width of said chamber, a return conduit for coolant directed to the interior of said nose member and located within said tube to communicate with the interior of said nose member, a supply conduit within said return conduit and in communication with the interior of said nose portion, said return conduit being threadedly joined to the rear wall of said nose portion, and the rear wall of said body member having openings at either side of said tube for the admission of and withdrawal of coolant supplied to the interior of the body member.

2. A cooling plate according to claim 1 wherein the internal chamber of the body member is provided with baffles extending substantially parallel to and located on either side of said tube.

3. A blast furnace cooling plate according to claim 1 wherein the two members are castings, and wherein said tube is cast integral with said body member.

4. A blast furnace cooling plate comprising a hollow body member and a separate hollow nose member having adjacent walls abutting one another, an outer wall of the body member being provided with openings enabling conduits to be connected thereto for admitting coolant to and discharging coolant from the interior of said body member, said body member having an internal tube continuous between said walls thereof, a return conduit within said tube having an end threadedly connected to the wall of said nose member that abuts said body member to thereby join and hold the nose member to the body member, the threaded end of said return conduit being in communication with the interior of said nose member to enable coolant to be discharged therefrom, and a separate supply conduit within said return conduit and communicating with the interior of said nose member to supply coolant thereto.

5. A cooling plate according to claim 4 wherein the nose member includes an internal support for the end of the supply conduit that is in communication with the interior of the nose member.

6. A cooling plate according to claim 4 wherein a metallurgical bond is afforded between the butted ends of the nose member and the body member.

7. A cast blast furnace cooling plate comprising a cast blade-like hollow body member having a rear wall and a front wall, a separate hollow cast nose member having a forwardmost front wall and a rear wall abutting the front wall of the body member, said body member having side walls and top and bottom walls defining a body interior of differential width, the interior of said body member being provided with an internal tube continuous between the front and rear walls and located substantially at the maximum width of said interior, said tube dividing the interior of the body member into two chambers and additionally serving as a baffle for coolant supplied thereto, said tube having a wall in common with one of said top

and bottom walls and being spaced from the other to afford a cross-over gap interconnecting said chambers, a return conduit for coolant directed to the interior of said nose member and located within said tube to communicate with the interior of said nose member, a supply conduit within said return conduit and in communication with the interior of said nose portion, said return conduit being threadedly joined to the rear wall of said nose portion as the connection between the body member and the nose member, and the rear wall of said body member having openings at either side of said tube for the admission of and withdrawal of coolant supplied to the interior of the body member.

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