

[54] CRUSHER PLATE

[75] Inventors: Masao Suzuki; Masayuki Oguni,
both of Tokai, Japan

[73] Assignee: Nippon Steel Corporation, Japan

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abandoned.

[30] Foreign Application Priority Data

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241/DIG. 13

[51] Int. Cl. B02c 11/08; B02c 13/02

[58] Field of Search 241/65-67,
241/DIG. 13, 189 R, 190, 86, 88, 88.4, 89

[56]

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Primary Examiner—Granville Y. Custer, Jr.
Assistant Examiner—Howard N. Goldberg
Attorney, Agent, or Firm—Toren and McGeady

[57]

ABSTRACT

A crushing plate for a crusher for crushing sinters comprising a jacket chamber provided in the crushing plate, a supply pipe for supplying cooling medium and an exhaust pipe, connected to the jacket chamber, and a liner covering a sinter-chuting portion of the crushing plate.

5 Claims, 18 Drawing Figures

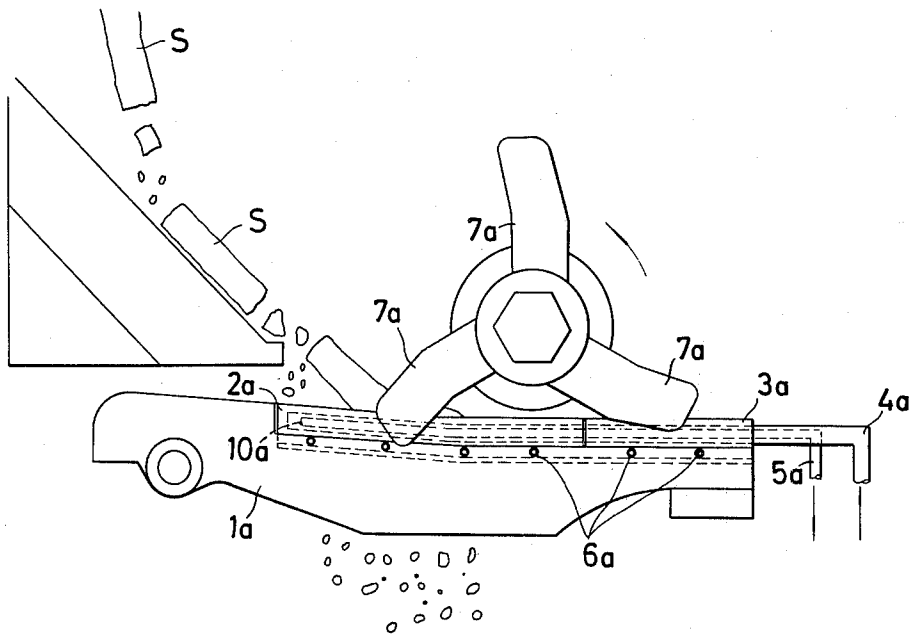


FIG.1 PRIOR ART

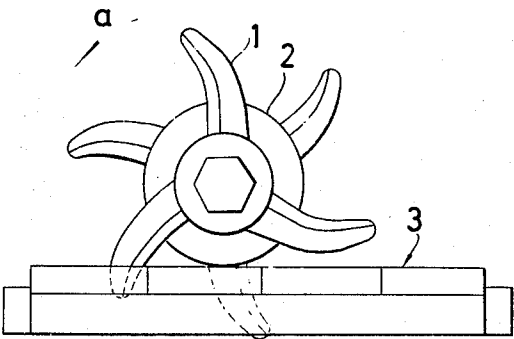


FIG.2 PRIOR ART

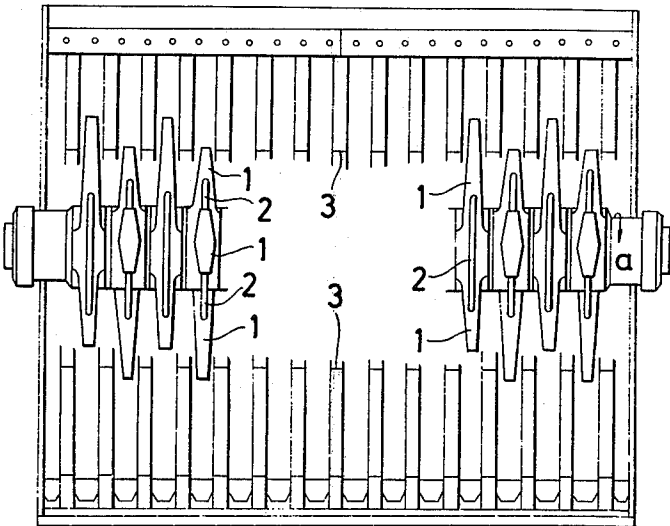


FIG.3 PRIOR ART

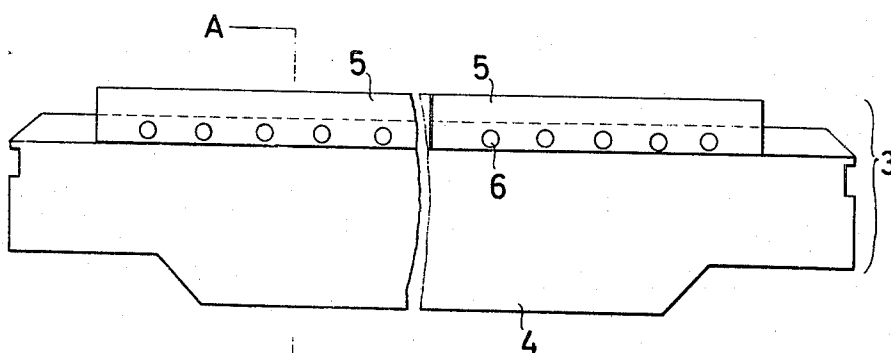


FIG.4 PRIOR ART

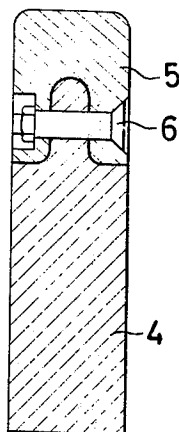


FIG. 5

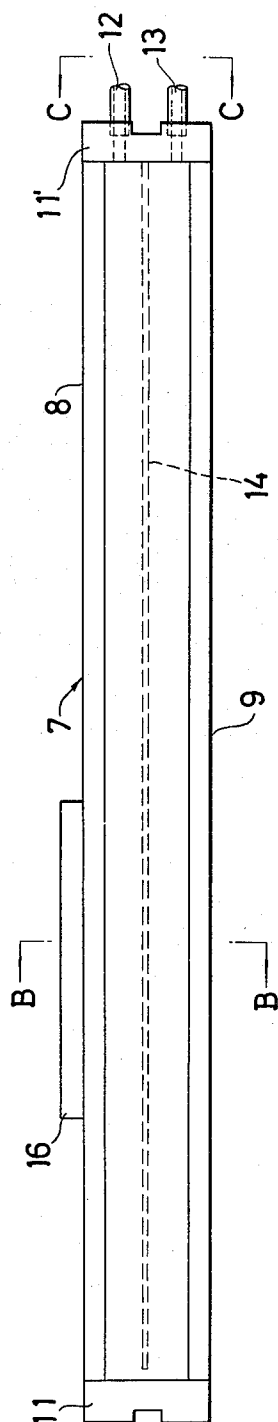


FIG.6

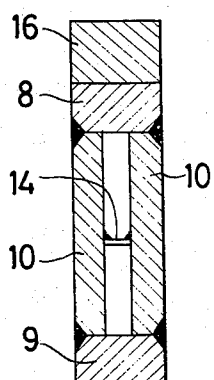


FIG.7

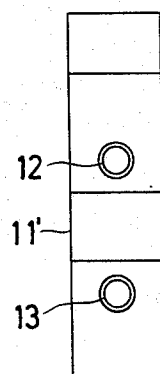


FIG. 8

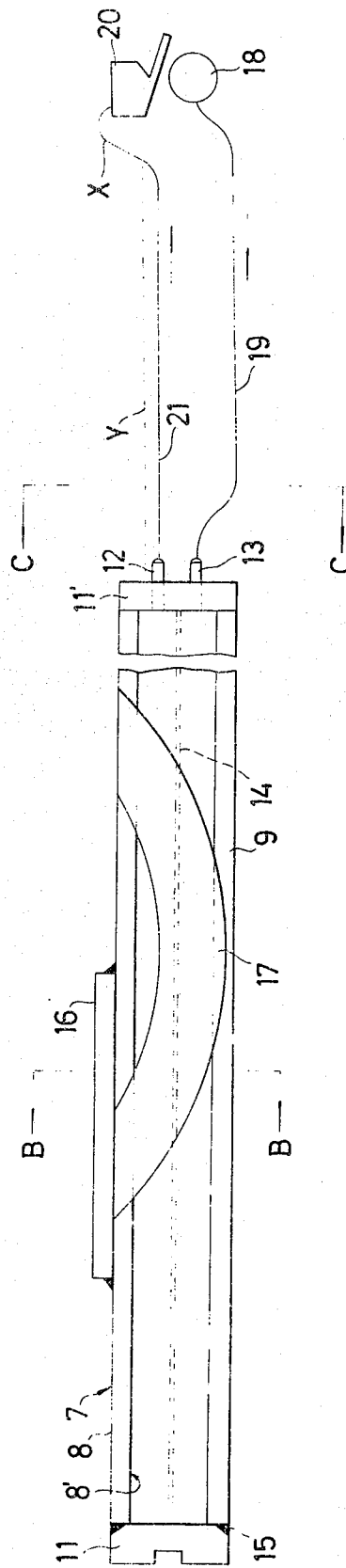


FIG.9

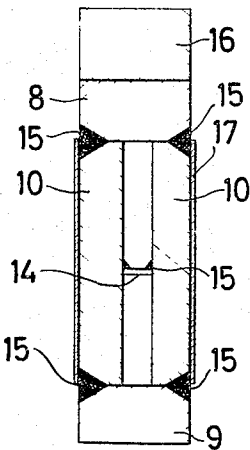


FIG.10

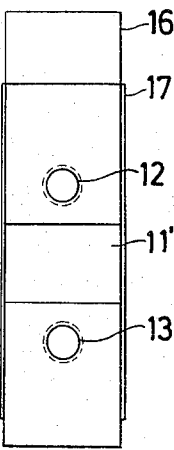


FIG.11

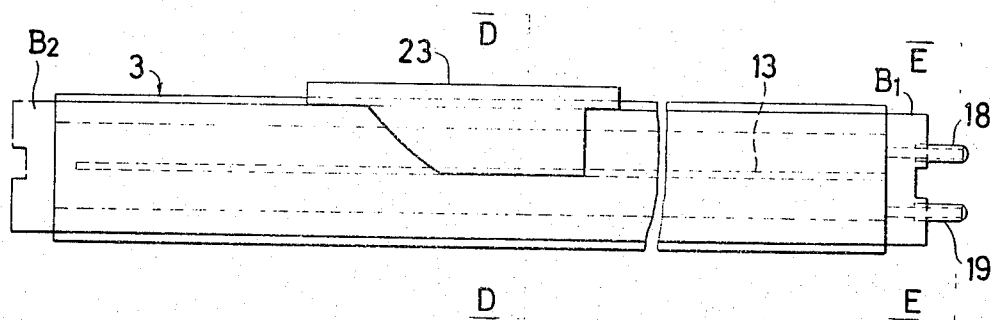


FIG.12

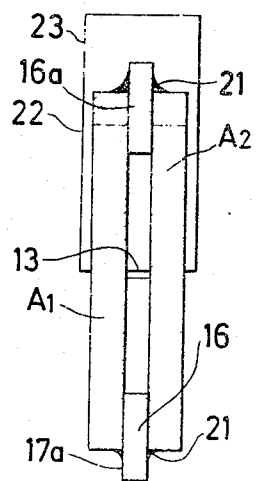


FIG.13

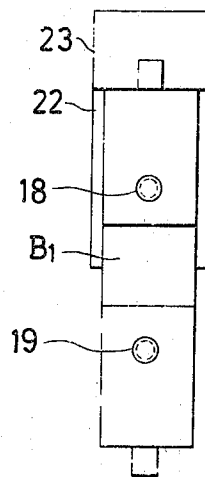


FIG.14

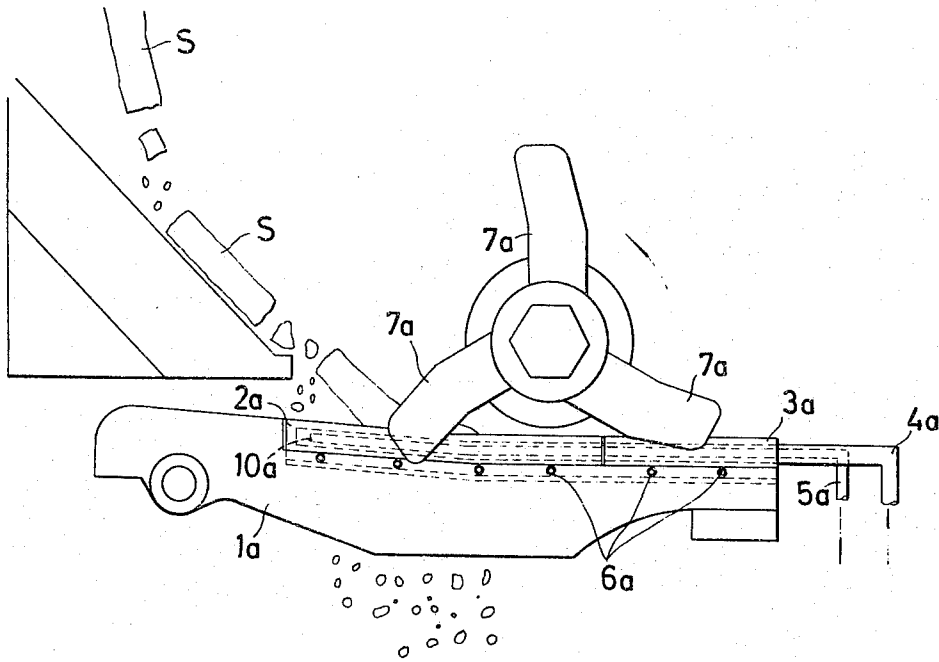


FIG.15

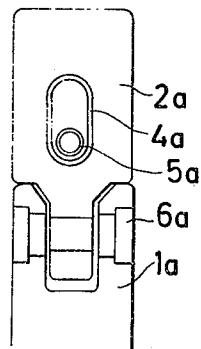


FIG.16

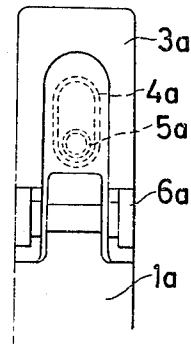
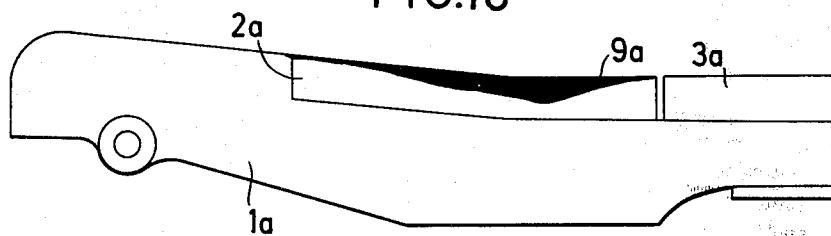


FIG.17



FIG.18



1

CRUSHER PLATE

This is a continuation of application Ser. No. 238,852, filed Mar. 28, 1972, now abandoned.

The present invention relates to crushing plates of a crusher for crushing hot sintered materials, and particularly relates to crushing plates having a cooling means for elongated service life.

According to a conventional crusher for crushing discharged sinters, discharged sinters are introduced between a rotating crushing blade and a crushing plate comprising a plurality of fixed crushing member where the sinters are sheared and crushed therein by the intermeshing of the blade and the crushing members. But the sinters themselves are at very high temperatures and the ambient temperature gets as high as 600°–800°C and particularly the size of sintering machines has been remarkably enlarged recently thus increasing the amount of sinters to be crushed by each crusher. And there have been various problems such that the portion of the crushing plates on which the sinters are chuted and the side walls of the crushing plates between which the rotating crushing blade passes are subjected to severe wear due to lowered hardness and are bent downward or laterally.

If high grades of heat resisting and wear resistant materials are used in order to overcome the above problems, the production cost will be increased. On the other hand, if low-cost materials are selectively used, only low wear resistance and heat resistance is assured, thus necessitating of frequent replacement of parts and components with new ones, inconveniences caused by stopping of the machines and lowering of the operational efficiency. Thus technical developments for assuring both the economy and the operational efficiency in better balance has long been sought.

Therefore, the object of the present invention is to provide crushing plates of a crusher at the discharge end of a sinter machine for crushing sinters, which eliminates the defects of the conventional crusher and is improved in both economy and operational efficiency.

The crushing plate according to the present invention comprises, a jacket chamber provided in the crushing plate and extending the whole length of the crushing plate, a supply means, such as a pipe, for supplying a cooling medium, connected to the jacket chamber, and liners on the portion of the crushing plate onto which sinters are chuted and the side walls of the crushing plate which engage with the rotating crushing blade. The crushing plate according to the present invention is preferably of a box like structure made of heat resistant materials and the liners may be provided by welding.

With the box structure of the crushing plate, the plate does not require machining and can be made from steel materials by a simple method, and the supply pipes for supplying cooling medium such as a cooling medium composed of a liquid and vapour can be easily connected to the jacket chamber.

The cooling system of the crushing plate according to the present invention is obtained by providing a supply pipe located at an end of the crushing plate for supplying cooling medium an exhaust pipe at least part of which is preferably positioned above the level of the crushing plate, and desirably a separation plate provided in the jacket chamber and extending almost all

2

length of the jacket chamber. The cooling medium flows all through the jacket chamber with or without the aid of the separation plate.

Further according to the present invention, the portion of the crushing plate on which sinters are chuted is covered by a liner (including overlaying by welding) so as to prevent the damage of the plate caused by chuting sinters, and the side wall of the plate, particularly the portions corresponding to the path of the rotating crushing blade is also covered by a liner (including overlaying by welding) to prevent the damage of the crushing plate caused by scratching and abrasion during the crushing operation of sinters. By the provision of the jacket chamber in the crushing plate, satisfactory cooling of both the plate itself and the liners is simultaneously attained, thus increasing remarkably the durability of the liners and thus the durability of the plate itself.

For providing the liners on the crushing plate, a heat and wear resistant steel material may be welded to the plate, a material such as a weld metal may be overlaid on the crushing plate by electro-slag welding or the liners may be provided by casting. The cross-sectional shape of the liner on the sinter chuting portion of the crushing plate is preferably a rectangular shape and the length of the liner covers at least the whole length of the sinter-chuting portion, and the liner on the side wall of the crushing plate is desirably 1 to 5 mm in thickness.

According to a fourth embodiment of the present invention, the crushing plate is composed of a separate crushing member and a base member; and the crushing member is attached to the base member and subjected to the most severe abrasion and is made separately and can be separated from the base member. This crushing member may be made by casting an alloy having high wear resistance, in which a supply pipe for supplying cooling medium is cast in, and is removably attached to the base member.

The crushing plate according to the present invention will be described in detail referring to the attached drawings.

FIG. 1 shows a side-view of a conventional crusher,

FIG. 2 shows a front view of the same,

FIG. 3 shows a side view of a crushing plate of the conventional crusher.

FIG. 4 shows a cross-sectional view along A—A line of FIG. 3.

FIG. 5 shows one embodiment of a crushing plate having a cooling mechanism according to the present invention, provided with a liner on the sinter-chuting portion.

FIG. 6 shows a cross-sectional view along the B—B line in FIG. 5.

FIG. 7 is an end view along the C—C line in FIG. 5.

FIG. 8 shows another embodiment of a crushing plate having a cooling mechanism according to the present invention, provided with a liner on the sinter-chuting portion and a liner on the side wall of the plate.

FIG. 9 shows a cross-sectional view along the B—B line in FIG. 8.

FIG. 10 shows an end view viewed from the C—C line in FIG. 8.

FIG. 11 shows a third embodiment of the crushing plate having the cooling mechanism according to the present invention.

FIG. 12 is a cross-sectional view along the D—D line in FIG. 11.

FIG. 13 is an end view viewed from the E—E line in FIG. 11.

FIG. 14 is a side view of a fourth embodiment of the present invention showing the relative portions of the crushing plate and the rotary crushing blade.

FIG. 15 is a cross-sectional view of the crushing member (cap) attached to the most severe wear portion of the third embodiment of the crushing plate according to the present invention.

FIG. 16 is a cross-sectional view of a cover-cap for protecting a circulation pipe for supplying and exhausting the cooling medium, attached to the plate adjacent to the cap shown in FIG. 15.

FIG. 17 is a plane view showing the wearing of the crushing plate.

FIG. 18 is a cross-sectional view of the same.

FIGS. 1-4 depict a crushing assembly of conventional structure according to prior art teachings. A rotary member 2 having projecting blades 1 is rotated in intermeshing relationship with a crushing plate comprising crushing members 3 with the blades 1 extending between the members 3. The rotary member 2 rotates in the direction of the arrow *a* and each of the members 3 comprise a cap liner 5 mounted on a plate body 4 by attachment 6, for example, a nut and bolt arrangement. The present invention, as described in detail hereinafter, differs from this conventional structure in the manner disclosed.

As shown in FIGS. 5-7 in a first embodiment of the invention, the crushing plate 7 is a hollow box structure, composed of the upper steel plate 8, the lower steel plate 9, a steel plate 10 fixed by welding to the upper and the lower steel plates 8 and 9, a jacket chamber provided therein, end plates 11 and 11' closing the both ends of the box structure, an exhaust pipe 12 and a supply pipe 13 provided through the end plate 11', the separation plate 14 provided in the jacket chamber, and the protective liner 16 provided by electro-slag welding on the sinter-chuting portion of the steel plate 8. The above structure shows larger cooling effects than those in case of a crushing plate having no such cooling mechanism.

As shown in FIGS. 8-10, in another embodiment, the crushing plate is of a box structure, composed of an upper steel plate 8, a lower steel plate 9, a steel plate 10 fixed by welding to the upper and lower steel plates 8 and 9, end plates 11 and 11' closing the both ends of the box and providing a jacket chamber therein, an exhaust pipe 12 and a supply pipe 13 provided through the end plate 11', a separation plate 14 provided in the jacket chamber for circulating the cooling water, a protective liner 16 attached by electro-slag welding to the sinter-chuting portion liner the upper steel sheet 8, and a liner 17 of 2mm thickness attached on the outside wall of the side plate 10 by hand welding using a heat resistant and wear resistant welding rod. The cooling water supplied from the supply main pipe 18 is introduced from a supply pipe 13 into the crushing plate 7 through a supply circuit 19 and is exhausted from an exhaust pipe 12 and discarded through an exhaust circuit 21 to an exhaust tank 20. In this case, a part X of the exhaust circuit 21 is positioned above the level Y of the lower surface 8' of the lower plate 8 as shown.

By this arrangement, the cooling medium supplied into the crushing plate 3 is assured to contact the whole

surface of the lower surface 8' of the lower plate 8 and desired cooling effects can be obtained. Comparison 1.

This comparison was made on the conventional crushing plate having no cooling mechanism shown in FIGS. 3 and 4. The treating capacity per one service life was 240,000 tons and its periodical repair had to be done every 35 days. The treating capacity per one service life and periodical repair of the crushing plates of Examples 1 and 2 of the present invention are listed in Table 1 in comparison with Comparison 1.

Table 1

	Treating Capacity (ton)	Periodical Repair
Example 1	609000	88
Example 2	907000	130
Comparison 1	240000	35

As understood from the above table, although advantageous effects can be obtained for increasing operation efficiency by the structure of Example 1, the service life of the crushing plate is increased by more than 3 times of that of Comparison 1 in which no cooling mechanism is applied, and by 1.5 times of that of Example 1 due to considerable decrease in damages of the side wall of the plate by wear and abrasion.

The third embodiment of the crushing plate according to the present invention will be explained referring to FIGS. 11 to 13.

In this embodiment, the protective liner is in the form of a cap liner. The cap liner may be provided by welding overlaying as an integrated liner continuously over both the sinter-chuting portion and a part of the side wall portions corresponding to the rotation path of the crushing blade, or may be provided by welding overlaying separately on the sinter-chuting portion and a part of the side wall portions corresponding to the rotation path of the crushing blade.

The sides surface of the protective liners are desirably a smooth surface in order to avoid abrasion.

In FIGS. 11 and 12, a closing fitting 16a held between the side plates A₁ and A₂ is positioned at the upper portion of the crushing plate and fixed by a fillet welding at the corner portion 21. And a similar closing fitting 17a is positioned at the lower portion of the crushing plate and fixed by a fillet welding at the corner portion 21.

B₁ and B₂ are end plates provided at both ends, 19 is a supply pipe and 18 is an exhaust pipe, both provided through the end plate B₁ and 23 is a cap-like protecting liner.

The cap-like protective liner is provided by electro-slag welding in a height of about 60mm from the upper end of the side plate and the thickness of the side-liner 22 is about 10mm over a part of the side wall portions corresponding to the rotational path of the crushing blade extending to the middle portion of the side wall of the crushing plate and the liner 23 is provided by welding overlaying.

The following advantages are obtained from the above structure.

The welded joints 15 in FIG. 9 for example of the sinter-chuting portion of the plate are not exposed and are not subjected to scratching wear or impact wear by sinters, so that leakage of cooling medium can be prevented. Further, even with a decreased width of the

plate, the cooling effect is not reduced and the protecting liner is also cooled satisfactorily and the service life of the plate is about 4 times longer than that of the conventional structure.

The fourth embodiment of the present invention will be described referring to FIGS. 14 to 18.

In FIG. 14, 1 is a base member, 2a is a water cooled cap (crushing member) made of wear resistant material, 3a is a cover cap, 4a is a supply pipe for supplying cooling water cast in the cap 2a, 5a is an exhaust pipe constituting a back path of cooling water circulation, inserted in the pipe 4a, 6a is a bolt and nut for joining the cap 2a and the cover cap 3a to the plate 1a, 7a identifies rotary crushing blades arranged in parallel, and S identifies hot sinters.

When the hot sinters which are continuously supplied from the sinter machine are sheared and crushed between the rotating crushing blades 7a and the crushing member 2a, the edge of the member 2a is severely worn, and particularly the portion 9a in FIG. 17 and 18 is most severely abraded.

In the present invention, the portion which is subjected to severe wear is protected by a separate cap (crushing member) 2a made of high wear resistance material and provided with supply pipes 4a and 5a cast therein for supplying cooling water. This separate crushing member 2a is attached removably to the base member 1a, and is easily replaced with a new one. The cross-sectional structure of the cap 2a is shown in FIG. 15.

The cap 2a is made of wear resistant alloy having a composition C:2%, Cr:26%, Ni:0.8% with one or more of W, Mo etc., and at the time of casting, the pipe 4a is cast in the cap for providing a cooling water circulating path. The cap is subjected to heat treatment to increase its hardness.

The exhaust pipe 5a is of smaller diameter and is inserted in the pipe 4a and serves for circulating the cooling water within the cap.

The cover cap 3a is attached to the portion subjected to less wear, and thus need not to be made of a special wear resistance alloy as required for the cap 2a. A similar material as used for the base member is satisfactory for the cap 3a. This cap 3a protects the pipes 4 for supplying the cooling water and the pipe 5a for exhausting the cooling water and also contributes for light crushing operation. In FIG. 16 which shows the cross-sectional structure of the cap 3a, the cap 3a has a J shape cross section and is attached to the base member 1a.

For cooling the crushing member, the supply pipe 4a is cast in the cap 2a and the pipe 5a is inserted in the supply pipe 4a.

The cooling water is supplied from the supply pipe 4a and passed into the end 10a of the pipe 5a and passed therethrough whereby the metal cap 2a is cooled.

According to the present invention, the crushing plate is not wholly cooled, but partially cooled. And as the base member 1a and the cap 2a are separated, the cooling is effected at remarkably high efficiency. Namely, the cooling effect to the base member 1a and

the cap 3a is not affected, and a constant cooling capacity is directed only to the cap 2a and thus the cooling is attained very efficiently.

Further, as the cover cap 3a protects the supply pipe 4a and also prevents radiant heat to the pipe 4a, it contributes advantageously to the cooling.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

We claim:

1. In a crushing apparatus for crushing hot sintered materials, said apparatus including a crusher plate formed with a plurality of spaced elongated crushing members and a rotary member having projecting blades rotating in intermeshing relationship with said crusher plate to effect therebetween crushing of said sintered materials, said blades extending to between said crushing members, the improvement comprising, in combination, means defining a jacket chamber interiorly of said crushing members said jacket chamber being formed by structuring said crushing members in a hollow box-like configuration, means for supplying a fluid cooling medium to said jacket chamber, means for exhausting said cooling medium from said jacket chamber, and liner means integrally bonded with said crushing members and covering said crushing members at least along portions thereof at which said sintered material is brought into contact with said crusher plate.

2. Apparatus according to claim 1 wherein said liner means are integrally bonded to said crushing members by being welded thereto.

3. Apparatus according to claim 1, wherein said liner means are integrally bonded to said crushing members by being cast thereon.

4. Apparatus according to claim 1, wherein said liner means extend to cover portions of said crushing members over which said projecting blades extend.

5. In a crushing apparatus for crushing hot sintered materials, said apparatus including a crusher plate formed with a plurality of spaced elongated crushing members and a rotary member having projecting blades rotating in intermeshing relationship with said crusher plate to effect therebetween crushing of said sintered materials, said blades extending to between said crushing members, the improvement comprising, in combination, means defining a jacket chamber interiorly of said crushing members, said jacket chamber being formed by structuring said crushing members as a box-like structure, said crushing members comprising a pair of side plates and upper and lower closing members fixed to extend between said side plates, means for supplying a fluid cooling medium to said jacket chamber, means for exhausting said cooling medium from said jacket chamber, and liner means covering said crushing members at least along portions thereof at which said sintered material is brought into contact with said crusher plate.

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