United States Patent

Motz et al.

[15] **3,682,227**

[45] **Aug. 8, 1972**

[54] **METHOD OF MAKING BI-METAL CRUSHER LINER**

[72] Inventors: **Jerome C. Motz; Francis Scaffidi,** both of Box 383, Milwaukee, Wis.

[22] Filed: **July 24, 1970**

[21] Appl. No.: **64,864**

Related U.S. Application Data

[60] Division of Ser. No. 842,818, July 8, 1969, Pat. No. 3,582,008, which is a continuation-in-part of Ser. No. 617,284, Feb. 20, 1967, abandoned.

[52] **U.S. Cl.** **164/94**

[51] **Int. Cl.** **B22d 23/00**

[58] **Field of Search** 164/93, 94, 95; 241/294, 295, 241/299, 300

[56] **References Cited**

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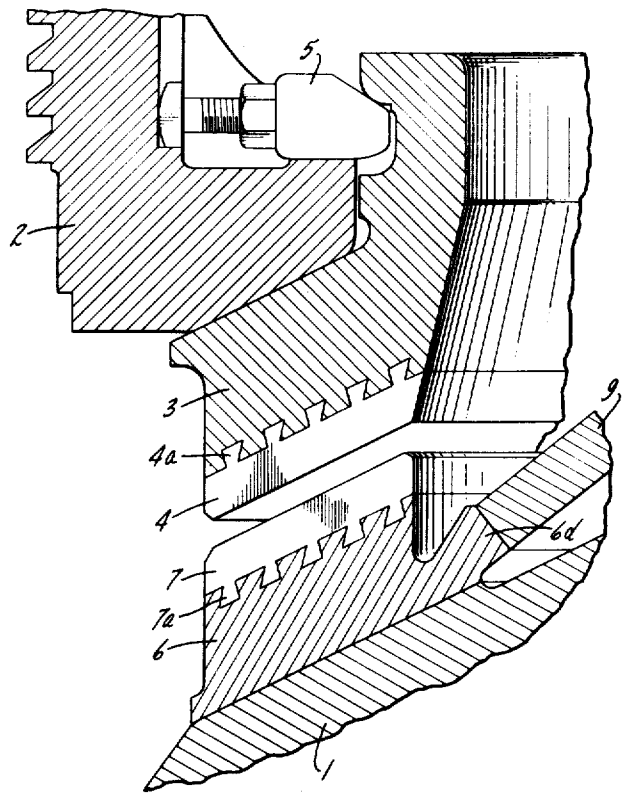
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Primary Examiner—J. Spencer Overholser
Assistant Examiner—John E. Roethel
Attorney—Parker, Carter & Markey

[57] **ABSTRACT**

This is a method of forming a wearing assembly for use in gyratory crushers whereby either the mantle or bowl liner of a crusher is made of a composition in which a backing member with a high tensile strength supports a crushing or working surface having high wear resistance. The working surface is in the form of discontinuous surface members permanently mounted on or cast integrally with the backing body and structurally connected only by the backing body.

2 Claims, 4 Drawing Figures



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SHEET 1 OF 2

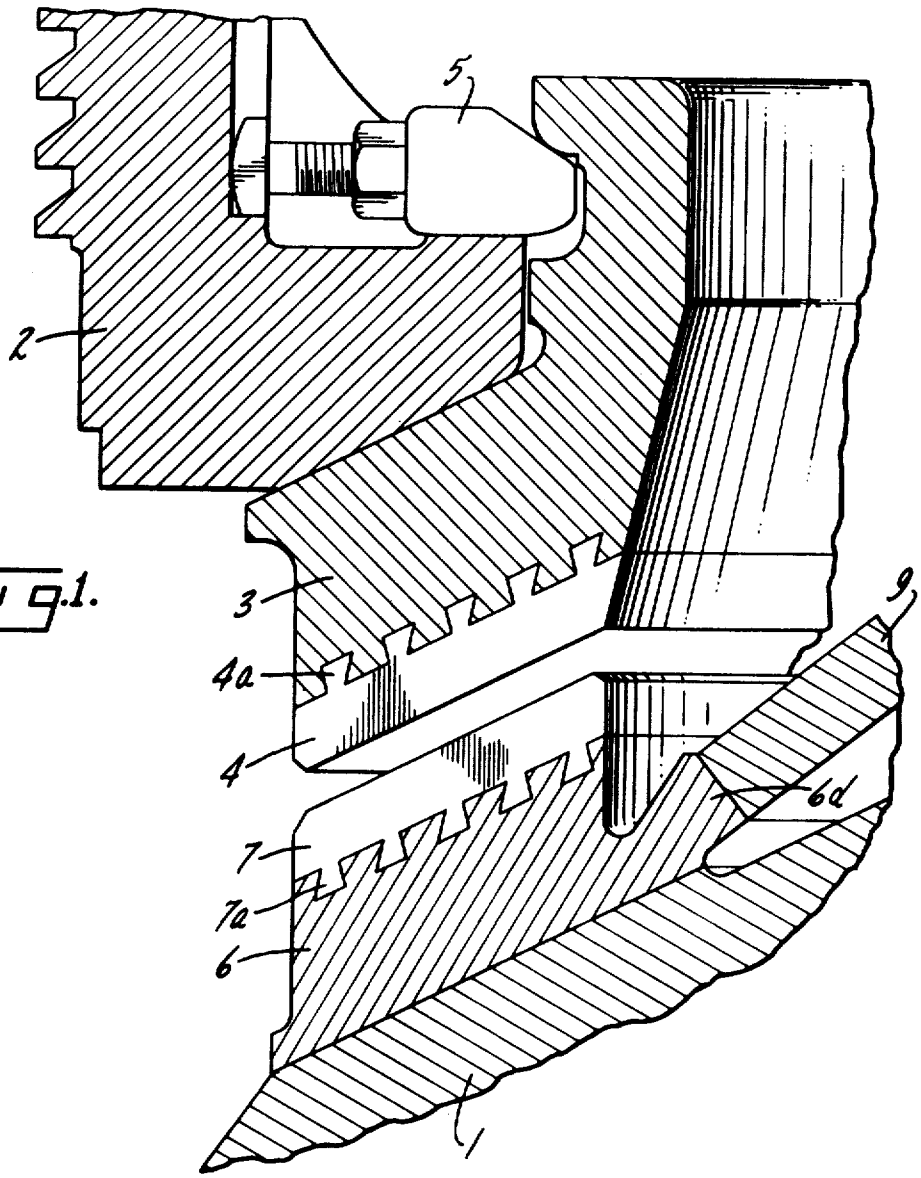


fig.1.

Fig. 2.

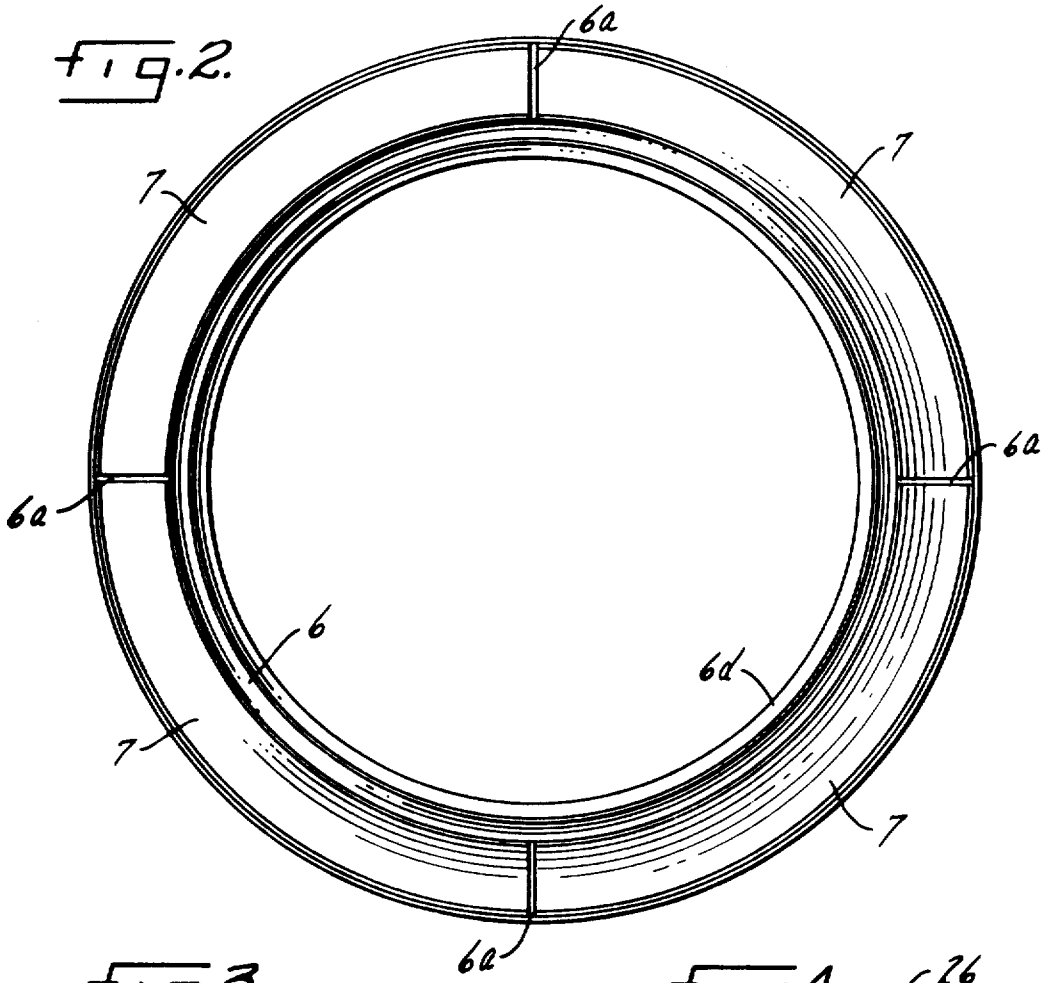


Fig. 3.

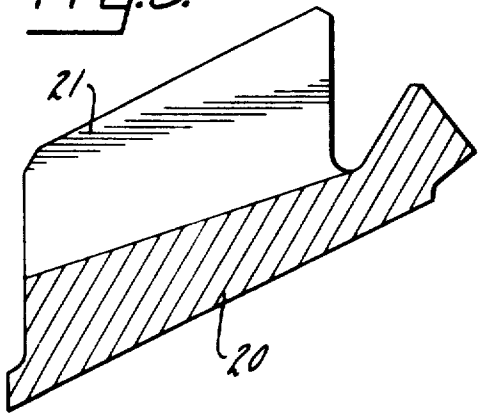
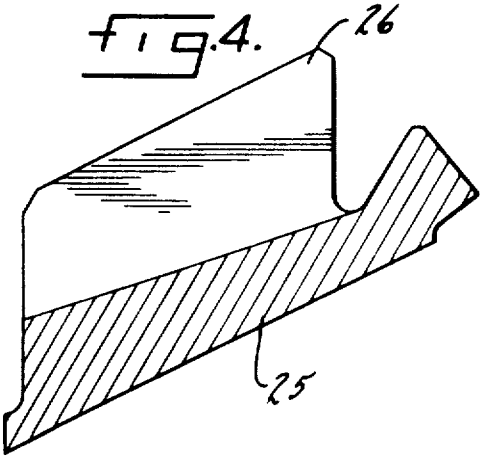


Fig. 4.



METHOD OF MAKING BI-METAL CRUSHER LINER

This is a division of Ser. No. 842,818, filed July 8, 1969, now U.S. Pat. No. 3,582,008, issued June 1, 1971, which was a continuation-in-part of Ser. No. 617,284, filed Feb. 20, 1967, now abandoned.--

The present invention relates to wear taking bodies or members which may be used, for example, with cone or gyratory crushers, in which a crushing head is employed with a surrounding bowl to define a crushing cavity. A typical crusher of this type is one in which the cone or head is gyrated within or beneath a bowl. The particular structures shown in the present application are wearing parts for use in crushers in which a head is gyrated to cause the wearing part or mantle of the head to move toward or away from the wearing part or liner of a surrounding bowl. The two wearing parts define a crushing cavity into which material is discharged from above to be reduced. The liner and the mantle take the crushing wear, and with some materials undergoing crushing this wear may be tremendous, for example, where taconite is being crushed. In any event, the liner and mantle wear away, and they may wear away very rapidly. The choice of materials for such wearing parts has hitherto been limited, in usual commercial practice, to metals which have relatively poor wear-taking characteristics, but which have great toughness, to enable them to stand crushing stresses without breaking or cracking. In the industry manganese steel has been a generally accepted material for bowl liners and mantles. This material, although tough, lacks the hardness of some other materials, and wears at a more rapid rate. On the other hand the hard steels, which have the highest wear resistance, are prevailingly far more brittle than manganese steel, and this brittleness involves the risk of the formation of cracks or breaks. Hence, this brittleness, the normal characteristic of the harder steels, has constituted a serious obstacle to the utilization in gyratory or cone crushers of those metals which have the highest wear resistance.

It is a purpose of the present invention of overcome the drawback of the brittleness of harder metals by employing facing parts of a metal of very high resistance to wear, these facing parts being secured to or supported on or against backing or supporting parts of a different material having greater tensile strength and adequate resistance to fracture. Thus we provide, in effect, a composite crushing or wear-taking member in which we are able to employ for the wearing surface parts metal of adequate hardness for maximum resistance, while providing, also, a backing or supporting or connecting structure of a different material, with the necessary tensile strength to stand up under the pounding, wear and stress inevitable in the operation of a crusher.

As will appear below, a wear-taking body or wearing part is cast from metals or alloys having originally, or by treatment, a high Brinnell hardness. Preferably, such parts or bodies are arranged as sections or segments about the crushing cavity, as will appear below.

Referring to the drawings:

FIG. 1 is a partial, vertical, axial section through a type of crusher having a normally fixed bowl and a head gyrated within and beneath it;

FIG. 2 is a plan view on a different scale, illustrating a plurality of wear-taking segments, such as are shown in the lower half of FIG. 1;

FIG. 3 is a partial axial section, on the same scale as FIG. 1, through a variant form of wear-taking segment and backing; and

FIG. 4 is a similar section through a variant form.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 generally indicates a head which may be gyrated, the supporting and gyrating structure of the head forming themselves no part of the present invention. 2 indicates a bowl structure normally fixed in relation to the crusher as a whole. It may, for example, be mounted on a circumferential frame, or on a supporting ring mounted on a circumferential frame, the details of the frame and supporting connection being not of themselves part of the present invention.

3 indicates a bowl liner having mounted on its face a wear-taking surface of harder material or metal, indicated at 4, and preferably formed in segments or separated parts. The backing portion 3 is preferably continuous throughout the circumference of the crusher, but applied to its lower surface are the plurality of wear-taking elements or segments 4. The surface or wear-taking segments or separate parts 4 are indicated as dovetailed into the lower surface of the liner 3, as at 4a. It will be understood that any suitable means may be provided for uniting the segments 4 firmly to the backing 3, and the dovetailing is indicated primarily as a matter of illustration, since it provides a satisfactory method of joining the two parts. It will be understood, for example, that the backing part 3 may be preformed and the segments or wearing parts 4 poured to interpenetrate. 5 is any suitable means, such as a wedge, for securing the bowl liner 3 in its normal crushing position.

A frusto-conic ring or support 6 is shown which may extend entirely around the head, a part of which is indicated at 1. The ring 6 may be of any suitable material which will resist cracking or breaking, and which is not expected to receive crushing wear. The crushing wear is to be taken entirely by the subsequently described segments or surface members 7. Turning to these segments, they may, if desired, be subsequently poured to interpenetrate with the backing member or ring 6, as at the dovetails 7*a*. Thus we provide a circumferentially continuous mantle or head covering 6, each one of these continuous members, of a metal which resists breakage, having formed on its wearing side a plurality of preferably separate bodies or segments of a harder metal adapted to resist crushing wear. A wide range of materials may be employed, including materials not necessarily metal, for example, ceramics. The material or metal selected for the protected parts 3 and 6 is chosen to resist breakage and to maintain its original form. The segments or wearing parts 4 and 7, on the other hand, are of metal far harder than the hitherto employed manganese steel. It will be realized, of course, that the invention is not limited to any specific metal mix or alloy.

In FIG. 2 we provide for the use of a multiple of segments 7, which, together, extend circumferentially about the lower part of the gyrated head 1. These segments are independent, in the sense that they are separated and not a continuous ring. The backing part 6, however, like the backing part 3 of the liner, is continuous and provides unitary support for the separately

positioned segments. An interval 6a is shown between adjacent segments. This interval may be somewhat exaggerated in FIG. 2 to emphasize the fact that the segments are separate parts, are not connected to each other, and, since they are separated, are freed of the tendency to crack or break, which a closed ring of the same brittle metal would have. On the other hand, the mantle and the liner as a whole are tied together by the backing members 3 or 6, which are of less brittle material than the wearing faces or segments. Under some special circumstances a non-metallic backing might be employed, such as an epoxy resin or a rubber carrier, with the metallic wear-taking parts or segments taking the entire wear. However, under normal circumstances, we find it advantageous to employ metallic backing layers as well as metallic wearing or surface segments.

Any suitable means may be employed for holding the mantle 6 in position. Illustrated, for example, is a pressure ring 9 of frusto-conic form which may abut the portion 6d of the backing ring 6. Its upper end may be suitably secured to the gyrated shaft, not shown, of the head 1, in such fashion as to subject the abutment portion 6d to a downward and outward thrust, effective to hold the lower surface of the ring 6 against the outer surface of the head 1. As the head 1 is gyrated, for example, the mantle moves toward and away from the bowl liner 3 and the entire wear is taken by the wearing surfaces 4 and 7, respectively. If desired, any suitable backing material, metallic or non-metallic, may be used between the outer surface of the head 1 and the opposed surface of the backing ring 6.

It will be understood that the specific formation, dimensions, shape and details of the various parts may be widely varied. For example, as shown in FIGS. 3 and 4, multiple poured parts may be employed. In FIG. 3, the part in section may be initially poured of a suitable backing metal or material, for example, a backing of a metal which will resist breakage or fracture. This portion is indicated as at 20. Thereafter, the pouring may be finished by the application of a wearing layer 21 of substantially harder material than the backing material or metal 20. When it is poured it can be poured with dividers. Thus, if four radial dividers are employed the appearance of the ensuing structure may be as in FIG. 2. In FIG. 4, the backing portion 25, of a suitable metal or material, will receive on its upper surface a wear-taking layer 26 which may be formed in sections generally as shown in FIG. 2, these sections to be bonded to the full lower ring 25.

The shapes of the circumferential supports 3 and 6 may be widely varied, and may be formed to fit various types, shapes, or sizes of head, or of concave, or of both. Whereas the use of four segmental wear-taking members has been illustrated, this number may be increased or diminished. A full ring or support is combined with a plurality of wear-taking members or segments of a suitable metal or alloy, the individual segments or members being secured in relation to the backing ring, but being divided apart so that they are free from the tendency to crack or break.

In accordance with the invention a bowl liner and a mantle are provided, each of which can be unitarily secured to the bowl or head with which they are employed, but each of which receives all wear upon special hard surfaces or members which are permanently secured to the circumferentially extending backing.

Whereas a practical and operative device has been shown and described, nevertheless many changes may be made in size, shape, number and disposition of parts without departing from the spirit of the invention. The drawings should be taken as in a broad sense illustrative or diagrammatic rather than as limiting to the specific disclosure therein.

The use and operation of the invention are as follows:

Various forms of wear-taking assemblies have been shown for use with a gyrated crusher head, and also with a normally fixed crushing bowl. In each of these assemblies wear-taking parts of hard material are exposed to wear, but are backed up by a circumferentially extending supporting or joining structure of softer material more resistant to breakage. It is important to have a plurality of hard or wear-taking parts or segments directly exposed to the material passing through and treated in the crushing cavity. These parts or segments perform the crushing or reducing function and receive all the wear or abrasion inevitable to such crushing. In each form shown the separate parts or segments are of a hard material or special alloy, which do not form a closed ring or cone, but are backed up by the somewhat softer material, preferably of metal, which forms a circumferentially extending backing, as at 3 or 6. They are protected from wear and are of a material chosen to prevent cracking, breakage or rupture. So far as necessary, an additional backing of a soft metal may be employed, such as a zinc, or a plastic material, such, for example, as is sold under the trade name NORDBAK by the assignee hereof.

As example of materials to be employed for the crushing segments or parts, pearlitic, carbidic white cast iron, or martensitic, carbidic, chrome-nickel alloyed cast iron, sometimes known as NIHARD, may be used. Castings from such metal may be brittle and hard, but they have excellent wear characteristics. The material of which the backing parts or rings are formed is not critical. What is important is that a metal or material be employed which will not readily crack or rupture. Since it is the purpose of the invention to have the hard wearing portions take the crushing contacts, the backing structures do not have to have high wear-taking characteristics.

We claim:

1. A method of forming a wearing assembly for the crushing part of a crusher of the gyrated head type which includes pouring a circumferential, generally frusto-conical continuous backing body of a metal of predetermined hardness formed and adapted to extend about and be removably supported against the crushing part, and adding to said backing body a plurality of discontinuous surface members each of substantial circumferential extent and formed of a material of greater hardness than the material of the backing body, while shaping said surface members with an otherwise generally continuous crushing surface to take substantially the entire crushing wear of the material being crushed when the crusher is being operated, and while maintaining a slight separation between the adjacent peripheral edges of the surface members, whereby, as a group, they are structurally connected only by the

backing body and present a generally frusto-conical continuous outer crushing surface.

2. The method of claim 1 characterized by pouring the surface members in an interlocking relationship with the backing body.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,682,227 Dated August 8, 1972

Inventor(s) Jerome C. Motz; Francis Scaffidi

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The Assignee [73] which was omitted should appear as follows:

[73] Assignee: Rex Chainbelt, Inc.
a corporation of Wisconsin

Signed and sealed this 10th day of April 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents