United States Patent

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Continuation-in-part of application Ser. No. 617,282, Feb. 20, 1967, now abandoned.

[54] **SEGMENTED CRUSHER LINER**
6 Claims, 5 Drawing Figs.

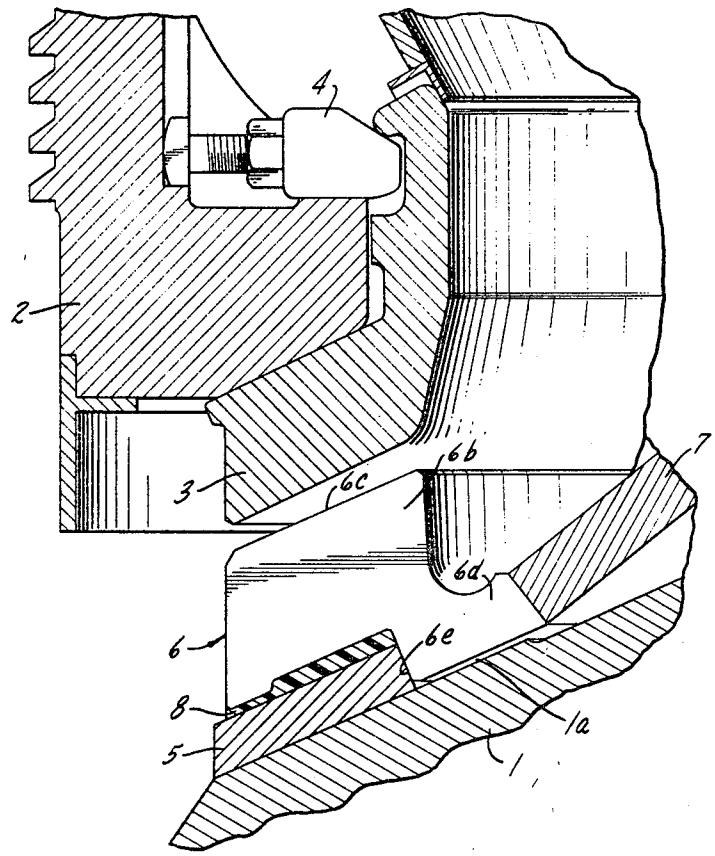
[52] **U.S. Cl.** **241/294**
[51] **Int. Cl.** **B02c 2/04**
[50] **Field of Search** ..... 241/292-5, 299, 300, 207—216

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ABSTRACT: A crusher of the gyrated head-type having a crushing head gyrated beneath or within a bowl. The mantle of the crushing head is formed of facing parts of a metal having a very high resistance to wear and a backing or supporting structure having less resistance to wear but greater tensile strength and adequate resistance to fracture.



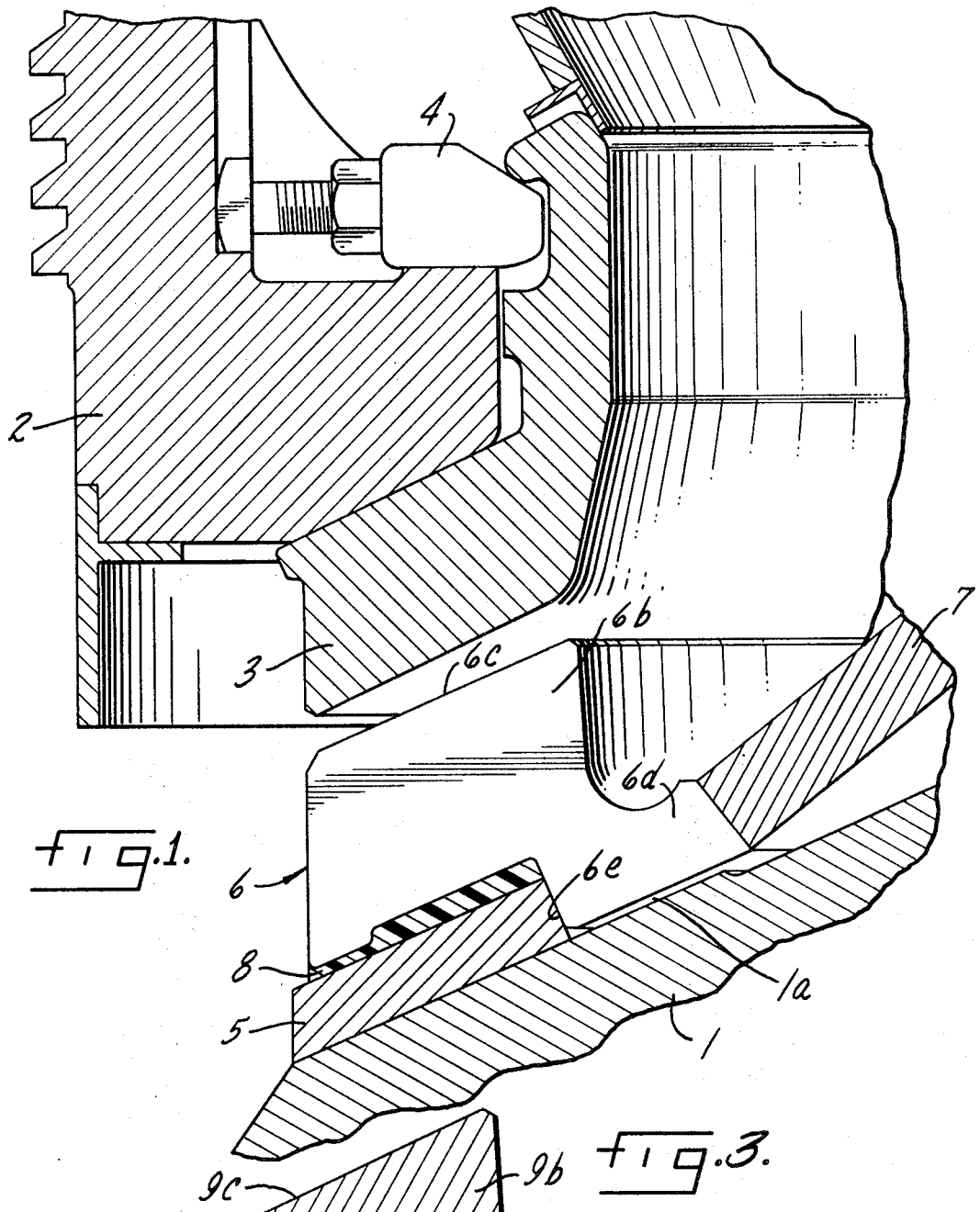


Fig. 1.

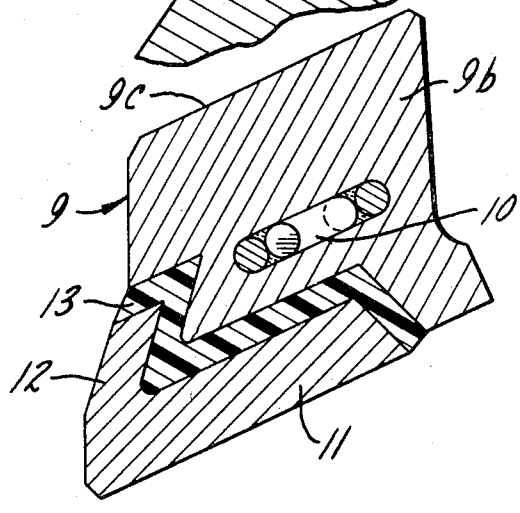


Fig. 3.

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fig. 2.

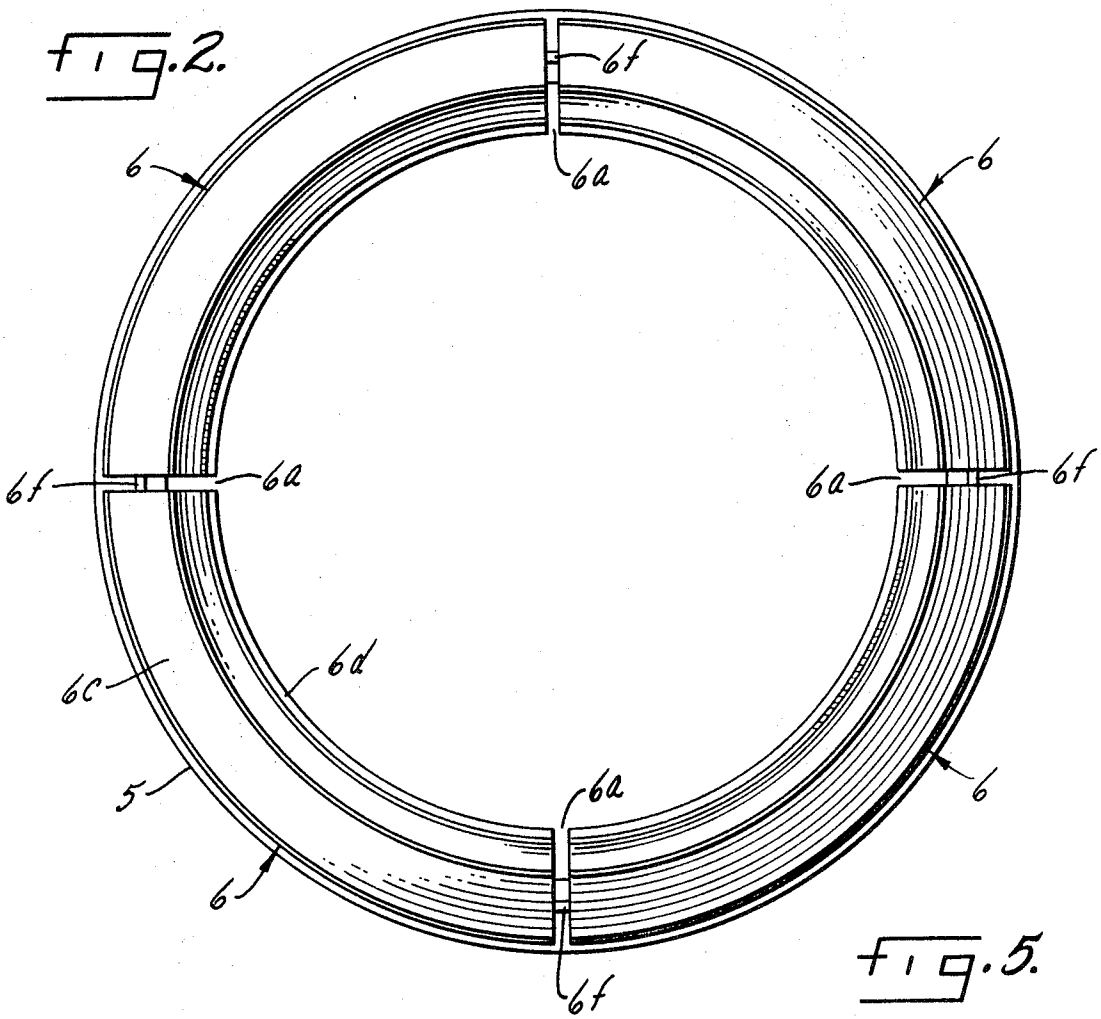


fig. 5.

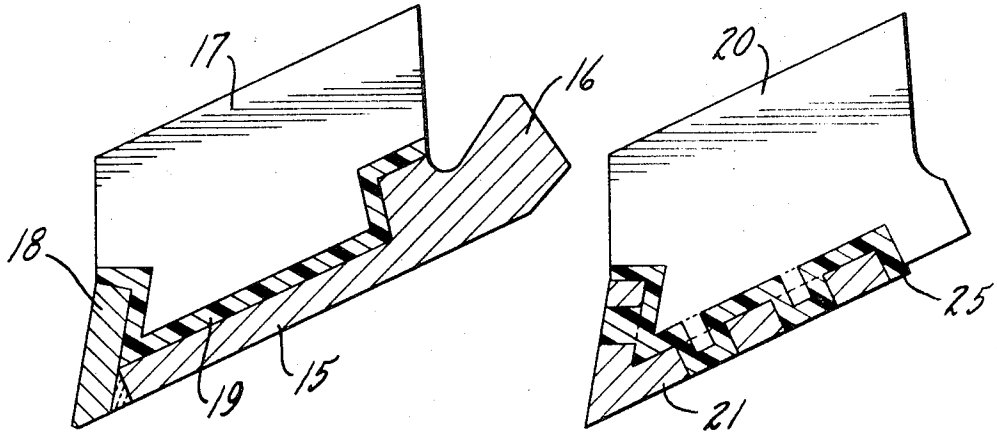


fig. 4.

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SEGMENTED CRUSHER LINER

This is a continuation-in-part of Ser. No. 617,282, filed Feb. 20, 1967, now forfeited.

SUMMARY OF THE INVENTION

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 to 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 I provide, in effect, a composite crushing or wear-taking member in which I am able to employ for the wearing surface parts metal of adequate hardness for maximum wear 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.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIGS. 4 and 5 are partial sections illustrating variant structures.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

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 which does not illustrate my invention, but is shown simply as a typical surrounding bowl liner within or against which the wearing parts may, in accordance with my invention, operate. 4 is any suitable securing means for holding the bowl liner 3 in its normal crushing position.

Turning to the lower part of FIG. 1, I illustrate a frustoconic ring or support 5 which may extend entirely around the head 1, and is shown as abutting a lower outer portion thereof. Under various circumstances it may be permanently, or semipermanently, secured to the head 1, or it may be made removable from the head 1, and simply dropped down on it. What is important is that it extends circumferentially about a lower portion of the head 1 and provides an abutment for receiving, positioning and supporting the below-described crushing segments. It will be understood that the ring 5 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.

Turning to the segments, 6,6 indicate typical segments which may be of a material of suitable hardness, far harder than the material of support 5, and far harder than the hitherto used manganese steel. A wide range of materials may be employed. It will be realized, of course, that my invention is not limited to any specific metal mix or alloy, except so far as I limit myself to them in the appended claims.

As will be clear from FIG. 2, I provide for the use of a multiple of segments 6, which, together, extend circumferentially about the lower part of the gyrated head 1. The segments may be initially connected by pieces or necks 6^f of restricted diameter. These can be broken, when the segments are in place, or may simply be left in place. I illustrate an interval 6^a between adjacent segments, this interval being somewhat exaggerated in FIG. 2, to emphasize the fact that the segments are separate parts, are not connected to each other, and, being already separated, are freed of the tendency to crack or break, which a closed ring of the same metal would have. As a matter of convenience, each of the segments, as shown in FIG. 1, has a large or thick wear-taking portion, indicated as 6^b, with a wearing surface 6^c. 6^d indicates an abutment portion, which is remote from the wearing surface 6^c, and which receives any suitable locking or thrusting ring or member, or members, 7, the details of which do not form part of the present invention. As an example, a frustoconic ring 7 may be formed to abut the portion 6^d of all of the segments 6 simultaneously, and 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 6^d to a downward and outward thrust effective to force the surface 6^e against the ring 5. Thus each of the segments 6 is held in position in relation to the ring 5, with its surface 6^c opposed to the opposite wearing surface of the bowl liner 3. As the head 1 is gyrated, for example, by the gyration of whatever shaft is employed with it, the segments 6 move toward and against the bowl liner 3 and subject the material fed from above to a crushing or disintegrating nip. The entire wear is taken by the wearing surface 6^c, and before the segments 6 are so deeply worn as to subject the ring 5 to wear they are removed from the crusher and replaced. It is a simple matter to handle them when separated, since each of these segments is of relatively small weight, as it extends only one-quarter of the way around the head or crushing cavity. They may be cast with the connectors 6^f. With this use of segments the material of the segment 6 is tailored or picked precisely to suit the crushing stresses and strains to which the segments are

subjected, while the material of the ring 5 is chosen to provide adequate backing, without cracking or breaking. If desired, any suitable backing material 8 may be used or inserted in the gap between the upper outer surface of the ring 5 and the lower surface of each segment 6.

It will be understood that the specific formation, dimensions, shape and details of the various parts may be widely varied. I may, for example, as shown in FIG. 3, employ embedded members of reinforcing material, such as steel of high tensile strength and resistant to fracture. Such reinforcing material is shown at 10 in FIG. 3, within the enlarged portion of a segment 9. In the form of FIG. 3, it will be understood that a multiple of segments is employed, and that there is independent reinforcement 10 for each of the segments, there being preferably no reinforcing connection between segments. Preferably, the reinforcement is placed at a substantial distance from the wearing surface 9^c, so that the reinforcement will not be exposed until the wearing part 9^b of the segment 9 has been substantially worn down. Then the segments may be removed and replaced. The securing means may, for example, be as shown in FIG. 1, with a suitable counterpart of the conic thrust ring 7.

It will be understood that the shape of the circumferential support 5 may be widely varied. I illustrate in FIG. 3, for example, a circumferential support 11 which has an outer, upper extension 12. As shown in FIG. 3, the wearing part 9^b of the segment 9 is shaped in order to provide a zone of separation 13 which may be filled by any suitable backing, whether of a soft metal or of a plastic. The specific backing does not of itself form part of the present invention. As shown in FIG. 1, a clearance is shown at 1^a between segments and head.

As an indication of the wide variations which may be made in shape of parts, while within the spirit of my invention, I illustrate, also, FIG. 4, in which a ring 15 extends all the way about the crushing head, with an abutting portion 16 which may receive, for example, the equivalent of the ring 7 of FIG. 1. 17 indicates a segment or insert which may be positioned on or about the ring 15. Any suitable number of these inserts may be employed, for example, the four shown in connection with FIG. 2. A clearance space 19 may be filled with any suitable backing. A circumferential ring 18 may, if desired, be employed. It forms part of the composite wear-taking structure and may be welded to the ring 15. In FIG. 4, rings 15 and 18 may extend entirely around the head and be held upon it by a suitable thrust against the portion 16, the members 17 constituting inserts, a plurality of which are put in the position in which the insert 17 is shown in FIG. 4. In the form of FIG. 4 the entire group, including a removable backing ring 15 and the ring 18, may be applied and removed together, resting upon the exterior of a head such as is shown at 1 in FIG. 1. In this instance a preformed wear-taking structure is provided with the rings 15 and 18 of breakage-resistant material and the insert 17 of harder wear-taking material, an adequate number of them being used, for example, the grouping of four, as shown in FIG. 2. If desired, they may be initially connected.

FIG. 5 again indicates a composite element in which the wear-taking member 20, of hard material, is anchored to a circumferentially extending structure, indicated at 21, which may have anchor openings. This structure forms part of a removable assembly, but whereas it extends continuously about the crushing cavity, the inserts or wearing parts or segments 20, of hard or brittle wear-taking metal, are separated from each other, for example, as shown in FIG. 2, though they may be initially cast or applied with connectors such as are shown at 6'. A suitable backing may be installed in the clearance space 25.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless, many changes may be made in size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my drawings to be taken as in a broad sense illustrative or diagrammatic rather than as limiting me to my specific disclosure herein.

The use and operation of the invention are as follows:

I have shown various forms of a wear-taking assembly for use with a gyrated crusher head. In each of these assemblies a wear-taking part, or parts, of hard material is exposed to wear, but is backed up by a circumferentially extending supporting or joining structure of a softer metal, more resistant to breakage. I find it important in all cases to have a plurality of hard wear-taking segments or parts exposed to the material passing through crushing cavity. These parts perform the crushing or reducing function and receive the wear or abrasion inevitable to such crushing. One reason for casting the wearing elements in the form of separate parts or segments, and for mounting these segments adjacently but individually, is that in foundry practice it has been found that high stresses develop internally in a complete ring during the casting and cooling process. In some cases these stresses may never be removed, with the result that a highly stressed casting is installed in a crusher. Additional stresses are applied to the circular casting in service, with the result that failure often results, even with comparatively low crushing forces. It is the employment of these separate parts or segments which makes it possible to use a more brittle material, since the castings are not subjected to the high internal foundry stresses which are inherently characteristic of the ring shape. If, in the course of crushing, a piece of tramp iron or uncrushable material enters the crushing cavity, the segment or part directly in contact with the tramp iron will receive the impact. Since the relatively brittle material used is not cast in a ring, this tramp iron contact with a single segment directly affects only the particular segment involved. Where a ring is used, of brittle material, the deformation caused by contact with the tramp iron extends around the circumference, and creates stresses which may result in failure of the entire member.

In each of the forms herein shown the separate parts or segments of hard material, which do not form a closed ring or cone, are backed up by the softer metal parts which form a circumferentially extending backing, which are protected from wear, and which are of a characteristic to prevent cracking, breakage, or rupture. So far as necessary, I also employ a backing which may be of soft metal, such as zinc, or which may be of a plastic material, such, for example, as is sold under the trade name "NORDBAK" by the assignee of the present application. Such a backing is illustrated at 8 in FIG. 1, at 13 in FIG. 3, at 19 in FIG. 4, and at 25 in FIG. 5.

As examples of materials to be employed for the crushing segments or parts I may mention pearlitic, carbidic white cast iron, or martensitic, carbidic, chrome-nickel alloyed cast iron, sometimes known as "NIHARD". 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 simply essential 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.

Whereas, in FIG. 1, I illustrate the bowl liner 3 as a single, circumferentially extending part, it will be understood that I may, if I wish, sectionalize the ring and separate it into a backing portion and wear-taking portion of different hardness and characteristics. It is thought unnecessary to go into details as to such modifications of the bowl liner.

I claim:

1. In a composite unitary wearing assembly to serve as a replaceable wearing part for the crushing chamber of a crusher of the gyrated head-type, a circumferential, generally continuous backing member of a material of predetermined hardness and strength, formed and adapted to extend about and to be removably supported in the crushing cavity against a part of the crusher, and a plurality of closely approaching surface members of a metal of substantially greater hardness and wear resistance than the material of the backing member, the surface members being mounted on, bonded to, and supported by the circumferential backing member so as to form a unitary element therewith, and being shaped and positioned to

take substantially the entire crushing wear of the material being crushed by the crusher, the surface members being of a substantially brittle material of great hardness as compared to the material of the backing member.

2. The structure of claim 1 further characterized in that the assembly is constructed and adapted to be mounted on the gyrated head of a crusher.

3. The structure of claim 1 further characterized in that the surface members are individually bonded to the backing member by a nonmetallic backing material.

4. In a wearing part for the crushing chamber of a crusher of the gyrated head type, a circumferential annular backing member extending completely about a lower, outer part of the crushing chamber, and a plurality of closely approaching surface members of a metal of substantially greater hardness than the material of the backing member, the surface members being positioned upon and seated against the circumferential backing member and being shaped and positioned to take substantially the entire crushing wear of the material being crushed when the crusher is being operated, the surface members each having a positioning surface directly engaging the backing member along a plane in the direction of application of the crushing stress and each having another surface spaced from a backing surface on the backing member in general parallelism with the crushing face of each surface member, and a filler of relatively soft material interposed between the backing surface of the backing member and the adjacent surface of each surface member, whereby to cushion the surface members in relation to the backing member.

5. The structure of claim 4 further characterized in that the wearing part is constructed and adapted to be mounted on the gyrated head of a crusher.

6. The structure of claim 4 further characterized in that the filler individually bonds the surface members to the backing member and is of a nonmetallic material.