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Strom

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[54] GRATE FOR REDUCTION MILL

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[52] **U.S. Cl.**.....**241/73**, 241/88, 241/189 R

[51] **Int. Cl.**.....**B02c 13/04**, B02c 13/13

[58] **Field of Search**.....241/73, 86, 88, 189 R, 196

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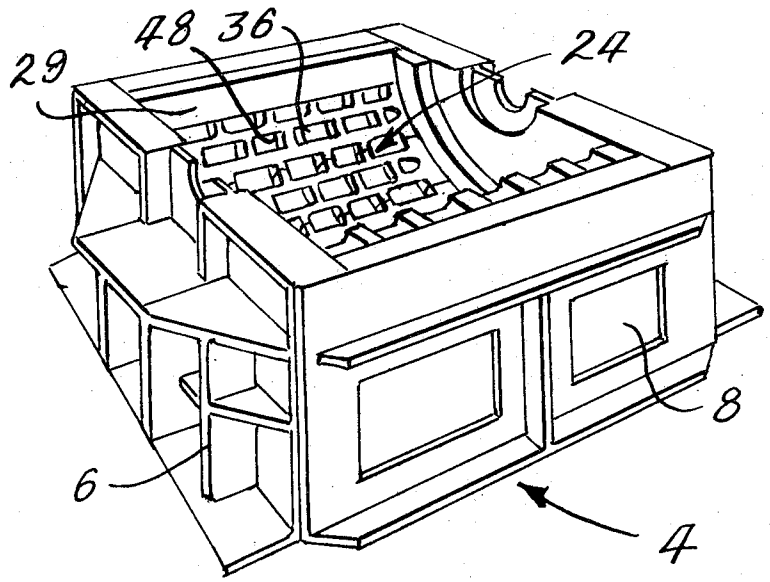
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[57] **ABSTRACT**

The grate of a reduction mill comprises a housing, a rotor, and a plurality of individual grate bar panels positioned side-by-side and arranged in an arc below the rotor in the housing. Each grate bar has two parallel ribs which extend axially through the housing and interconnecting the ribs are axially spaced connectors which in combination with the ribs form openings contained wholly within the individual grate bar panels. Spacers project outwardly and circumferentially from the ribs, and the spacers are axially offset from the connectors. The spacers of adjacent grate bar panels abut and create more openings in the grate. These other openings are axially offset from the openings contained wholly within the individual grate bar panels. Since the spacers and the connectors, and likewise the two types of openings, are staggered, the grate wears evenly and does not tend to wear a groove-like indentation, as do conventional grates.

7 Claims, 7 Drawing Figures



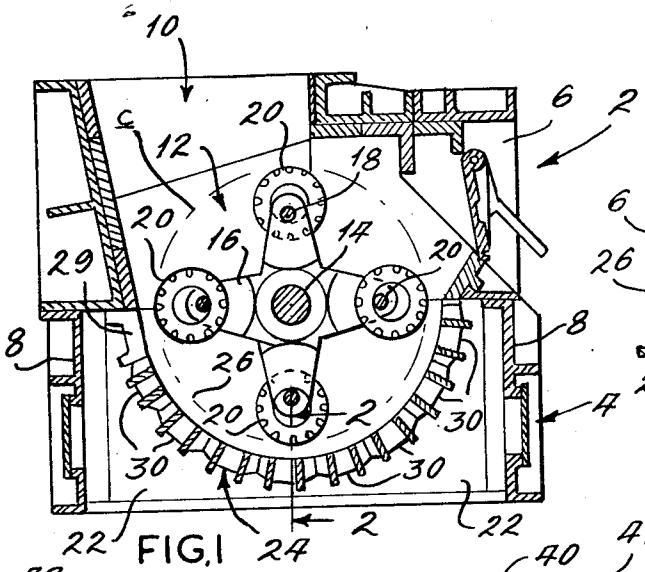


FIG. 1

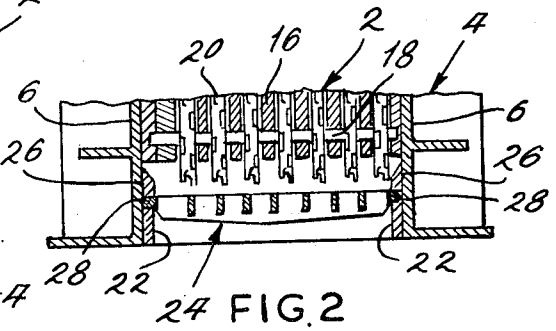


FIG. 2

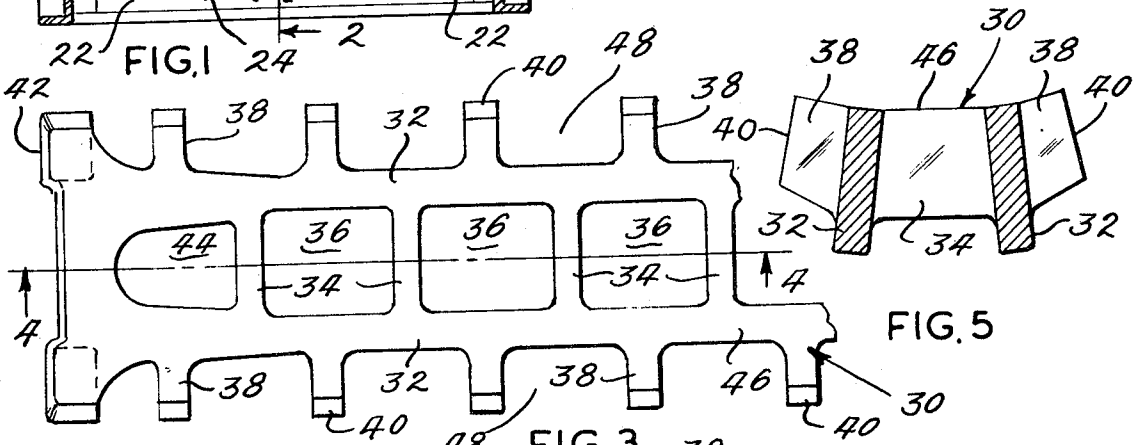


FIG. 3

FIG. 5

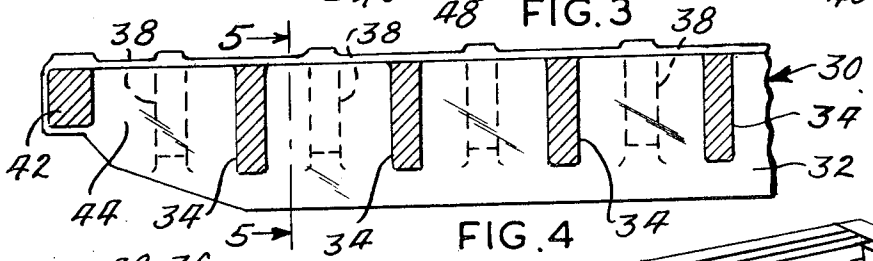


FIG. 4

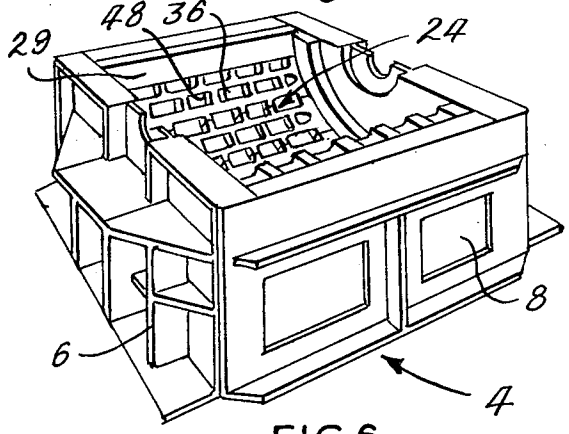


FIG. 6

Prior Art

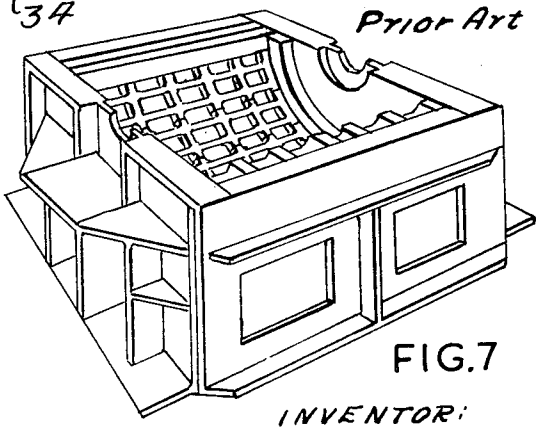


FIG. 7

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GRATE FOR REDUCTION MILL

BACKGROUND OF THE INVENTION

This invention relates in general to reduction mills, and more particularly to grates and grate bar panels for reduction mills.

Reduction mills, such as crushers, grinders, shredders, pulverizers, and the like, reduce materials to relatively small fragments to facilitate handling of the material and to place such material in a condition more suitable to subsequent processing. Most reduction mills have three basic components, namely a housing, a grate in the housing, and a rotor provided with rings or hammers which pass close to the surface of the grate. The reduction is achieved by introducing the material into the path of the rotating rings or hammers, and the accompanying impact with the rings or hammers alone is enough to achieve partial reduction. Further reduction occurs as the hammers carry the material across a breaker bar and subsequently across the grate. When the reduced fragments of material are small enough, they pass through the grate openings and leave the machine.

The openings in conventional grates are aligned in both circumferential and axial rows and consequently form the common grid pattern. The grate of course wears, and most of this wear occurs in the axially extending pieces separating adjacent openings in each circumferential row so that in time a series of circumferentially extending channels or grooves are created in the grate (FIG. 7). The circumferentially extending pieces separating adjacent openings in each axial row do not wear nearly as much and consequently create a series of circumferential ribs separating the circumferential channels. The presence of the channels and ribs in the grate enables the material to be carried around with the rotor time after time, and this in turn compounds the wear on the grate. Consequently, the reduction mill does not purge itself of the reduced material as rapidly and likewise cannot accept the unreduced material as rapidly. In other words, the capacity of the machine decreases when channels are worn into its grate. Also, greater horsepower is required to reduce an equivalent amount of material when the grate is channelled.

SUMMARY OF THE INVENTION

One of the principal objects of the present invention is to provide a reduction mill grate assembly which wears evenly and does not tend to develop channels as it wears. Another object is to provide grate panels for a grate of the type stated which may be used for extended periods of time before being replaced. A further object is to provide a grate of the type stated which enables the reduction mill to operate at greater capacity and with less power. An additional object is to provide grate panels which may be installed in existing reduction mills. These and other objects and advantages will become apparent hereinafter.

The present invention is embodied in a reduction mill grate comprised of individual grate bar panels having axially extending ribs and circumferentially extending connectors and spacers. The grate bar panels are configured to produce staggered openings in the grate so that the panels wear evenly. The invention also consists in the parts and in the arrangements and combinations of parts hereinafter described and claimed.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form part of the specification and wherein like numerals refer to like parts wherever they occur:

FIG. 1 is a sectional view of a reduction mill provided with a grate assembly constructed in accordance with and embodying the present invention;

FIG. 2 is a fragmentary sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary plane view of a grate bar panel forming part of the grate assembly;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an end view of the grate bar panel of FIG. 3;

FIG. 6 is a fragmentary perspective view showing the lower half of a reduction mill housing having the grate assembly of the present invention therein; and

FIG. 7 is a perspective view similar to FIG. 6, but showing a conventional grate assembly.

DETAILED DESCRIPTION

Referring now to the drawings, 2 designates a reduction mill which may be a crusher, grinder, shredder, pulverizer, or the like. The mill 2 includes (FIG. 1) a housing 4 provided with side walls 6, end walls 8, and an upwardly presented opening 10 leading into its interior. The housing 4 supports a rotor assembly 12 which for the most part is disposed within the housing interior. The rotor assembly 12 includes a rotor shaft 14 which is journaled in bearings located adjacent to the side walls 6, and a series of abutting spiders 16 which are keyed to the shaft 14. These spiders 16 carry ring shafts 18 which in turn retain reduction elements or shredder rings 20 between parallel arms of the adjacent spiders 16. As the rotor 12 revolves, the centrifugal force exerted on the rings 20 urges them outwardly so that they project beyond the spiders 16 and describe a hammer circle *c*. In lieu of the spiders 16, solid disks may be used to retain the ring shafts 18. Likewise, hammers may be used in lieu of the ring 20. Bolted against each side wall 6 are grate supports 22 which underlie the ends of a grate 24, providing subjacent support therefor. The grate 24 extends along approximately the lower half of the hammer circle *c* and is further positioned by arcuate liners 26 which overlie the ends thereof and like the grate supports 22 are bolted to the side walls 6. In effect, the arcuate liners 26 and the grate supports 22, create arcuate channels 28 along the inside faces of each side wall 6, and the ends of grate 24 are confined in these channels 28 (FIG. 2). The grate 24 commences at a solid breaker bar or grinding plate 29 which transverses the housing 4 below the opening 10 and also has its ends confined in the arcuate channels 28.

The grate 24 is composed of a series of individual grate bar panels 30 set side-by-side and arranged in an arc beneath the lower half of the hammer circle *c*. The ends of the individual grate bar panels 30 project into the arcuate channels 28 and are confined by the liners 26 and grate supports 22 which define those channels. The grate bar panels 30 are cast from manganese steel or other type of alloy steel analysis and consequently are extremely hard and resistant to wear. When fitted side-by-side, the grate bar panels 30 provide a multitude of openings in the grate 24 (FIG. 6) and these

openings are staggered such that adjacent openings in the circumferential direction do not align. In contrast to this arrangement of grate openings, conventional grates have their openings aligned in circumferential rows (FIG. 7) which causes uneven wear and eventually circumferential grooves in the grate.

Each grate bar panel **30** (FIGS. 3–5) is cast as an integral unit and includes a pair of longitudinally extending ribs **32** which are parallel and spaced from one another. The ribs **32** are joined by a series of transversely or circumferentially extending connectors **34** which are equally spaced along the panel **30** and with the ribs **32** form generally rectangular opening **36** therein (FIG. 3). The upper surfaces of the ribs **32** and connectors **34** are flush, but the under surfaces are not inasmuch as the ribs **32** are somewhat deeper than the connectors **34** and therefore project below them. Each panel **30** is also provided with a series of spacers **38** which project laterally from the ribs **32** and terminate at planar abutment faces **40**. Corresponding pairs of spacers **38** on the opposite ribs **32** align with each other but are offset with respect to the connectors **34**. In other words, the spacers **38** project from the ribs **32** intermediate the connectors **34** and are centered on the openings **36**. LIke the connectors **34**, the spacers **38** have their upper surfaces flush with the upper surfaces of the ribs **32** and are not as deep as the ribs **32**.

At the ends of each grate bar panel **30**, the ribs **32** merge into arcuate mounting portions **42**, the depth of which is somewhat less than the depth of the ribs **32**. The lower surfaces of the mounting portions **42** are set upwardly from the lower surfaces of the ribs **32** so that the undersides of ribs **32** near the ends thereof taper toward the lower sides of the mounting portions **42**. The arcuate mounting portions **42** possess generally the same radius of curvature as the arcuate channels **28** on the side walls of the housing **4**, and indeed fit within those channels **28**, so that each grate bar **30** traverses the interior of the housing **4**, and is confined at its end portions **42** by the walls of the channels **28**. The rectangular openings **36** do not extend out to the end portions **42**, but are separated from the end portions **42** by end openings **44** which are squared off at their inner ends and rounded at their outer ends.

As previously noted, the upper surfaces of the ribs **32**, connectors **34**, and spacers **38**, are flush and in combination form an arcuate upper surface **46** (FIG. 5) on the grate bar panel **30**. The radius of curvature of the arcuate upper surface **46** is slightly greater than the radius of the hammer circle *c*, and abutment surfaces **40** at the free ends of the spacers **38** are perpendicular to the arcuate upper surface **46**.

The grate bar panels **30** are installed in the housing **4** by inserting their mounting portions **42** into the ends of the arcuate channels **28** and thereafter allowing them to slide through the channels **28** to their respective positions within the housing **4**. When the grate bar panels **30** are properly positioned, the abutment faces **40** on the spacers **38** of adjacent panels **30** will facewise abut, and these abutting spacers **38** coupled with ribs **32** from which they project will form a series of substantially rectangular openings **48** across the grate **24**. In other words, the grate **24** has two types of openings, namely, those contained entirely within the individual grate bars **30**, that is the openings **36** and **44**, and those formed along the sides of abutting grate bar panels **30**, namely the openings **48**. The latter actually are created by the voids between successive spacers **38** on adjoining grate bar panels **30**. The openings **48** are substantially the same size and shape as the openings **36**.

Since the spacers **38** of each individual grate bar panel **30** are centered on the openings **40** contained entirely within that panel **30**, the openings **48** defined by the abutting spacers **38** are axially offset or staggered with respect to the openings **36**. State differently, in a circumferential direction along the entire grate **24**, the openings **48** align in successive circumferential rows, and so do the openings **36**, but the circumferential rows of openings **48** are offset from the circumferential rows of openings **36**. In this same vein, the spacers **38** and connectors **40** do not align (FIG. 6) and consequently a series of continuous circumferential ribs does not exist in the grate **24** as is true of conventional grates (FIG. 7).

In use, material to be reduced is introduced into the reduction mill **2** through the opening **10** of the housing **4**. This material falls into the path of the rotating shredder rings **20**, and the initial impact with the rings **20** is usually enough to effect a partial reduction. Thereafter, the material is drawn across the grinding plate **29** where further reduction occurs. The material which is small enough to pass through the openings **36**, **44** and **48** in the grate **24** does so, and accordingly is discharged from the housing **4**. The remainder is carried along the curved upper surface of the grate **24**, that is the surface composed of the arcuate surfaces **46** on the individual panels **30**, by the revolving shredder rings **20** and is crushed or shredded still further. The crushing and shredding against the curved upper surface of the grate **46** continues until the material is small enough to pass through the grate openings **36**, **44** and **48**.

Inasmuch as the openings **36** and **48** are axially offset or staggered, the spacers **38** do not form continuations of the connectors **34**, and consequently the grate **24** does not tend to groove as it wears. On the contrary, it wears evenly, and as a result it lasts considerably longer than conventional grates. Moreover, the absence of any grooving increases the capacity of the reduction mill, for the shredder ring **20** continues to pass close to the upper surface of the grate **24**, and this reduces the tendency of the rotor **12** to carry the material around time after time within the housing **4**. Excessive grooving, on the other hand, creates large circumferential gaps between the hammer circle and the grate at each ring, so that the material does not reduce rapidly, but on the contrary is carried around and around by the rotor, thus preventing the entry of more material into the paths of the shredder rings. The absence of grooving in the grate **24** further enables the reduction mill **2** to reduce material with the minimal power.

This invention is intended to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

1. In a reduction mill having a housing in which a rotor provided with impact elements revolves, an improved grate mounted in the housing outwardly from

the circle described by the impact elements, said grate comprising a plurality of individual grate bar panels, each comprising axially extending parallel ribs, means connecting the ribs and forming a plurality of first apertures between them, and axially spaced spacers projecting outwardly and circumferentially from the ribs, the spacers of adjacent grate bar panels abutting to form a plurality of second apertures along the juxtaposed sides of adjacent grate bar panels, the second apertures being axially offset from the first apertures, whereby the grate will wear evenly.

2. The structure according to claim 1 wherein the means connecting the ribs comprise circumferentially extending connectors extending between the ribs and forming the sides of the first openings; and wherein the connectors are axially offset from the spacers.

3. The structure according to claim 2 wherein the first openings and second openings are substantially the same size and shape.

4. The structure according to claim 2 wherein the ribs, spacers, and connectors of each rate bar panel are cast integral with one another, and have the surfaces which are presented toward the rotor flush.

5. The structure according to claim 2 wherein each grate bar panel further comprises an arcuate mounting portion at the ends of the ribs, and wherein the mounting portions fit into arcuate channels in the housing, whereby the channels confine the grate bar panels.

6. The structure according to claim 4 wherein flush surfaces of the ribs, spacers, and connectors form the arcuate upper surface of the grate bar panel; and wherein the radius of curvature for the arcuate upper surface is slightly greater than the radius of the circle described by the revolving impact elements.

7. The structure according to claim 6 wherein the spacers of each grate bar panel terminate at planar abutment surfaces which are perpendicular to the arcuate upper surface of the grate bar panel; and wherein the planar abutment surfaces on adjacent spacers within the grate facewise abut.

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