United States Patent [19]

Fabert, Jr.

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[45] **June 12, 1973**

[54] **IMPROVED HAMMER FOR HAMMER MILLS**

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[73] Assignee: **Abex Corporation**, New York, N.Y.

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[21] Appl. No.: **162,358**

[52] **U.S. Cl.** **241/195**
[51] **Int. Cl.** **B02c 13/28**
[58] **Field of Search** 241/194, 195, 196, 241/197, 27, 30

[56] **References Cited**

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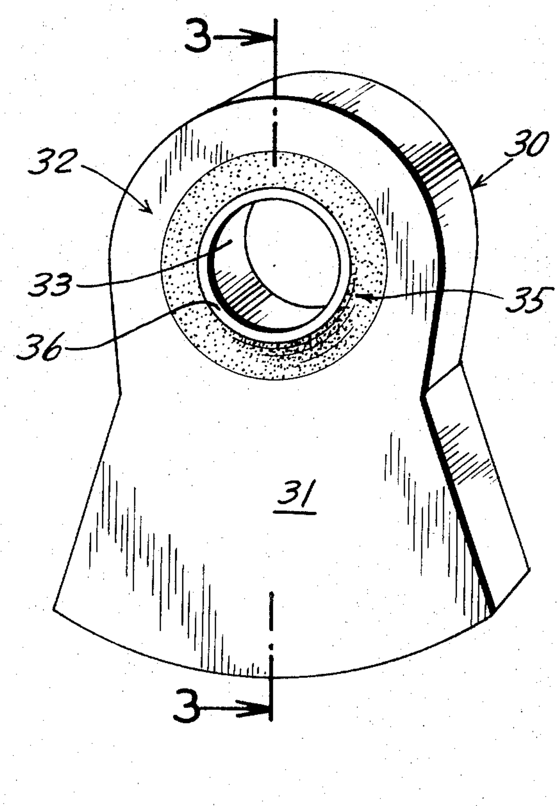
[57] **ABSTRACT**

A hammer for a hammer mill, cast from austenitic manganese steel, is cast with a pad of extra metal surrounding the eye, the extra metal being work hardened to inhibit stretching of the eye when the hammer is revolved with its supporting rod which fits the eye diameter.

2 Claims, 5 Drawing Figures



Patented June 12, 1973 3,738,586

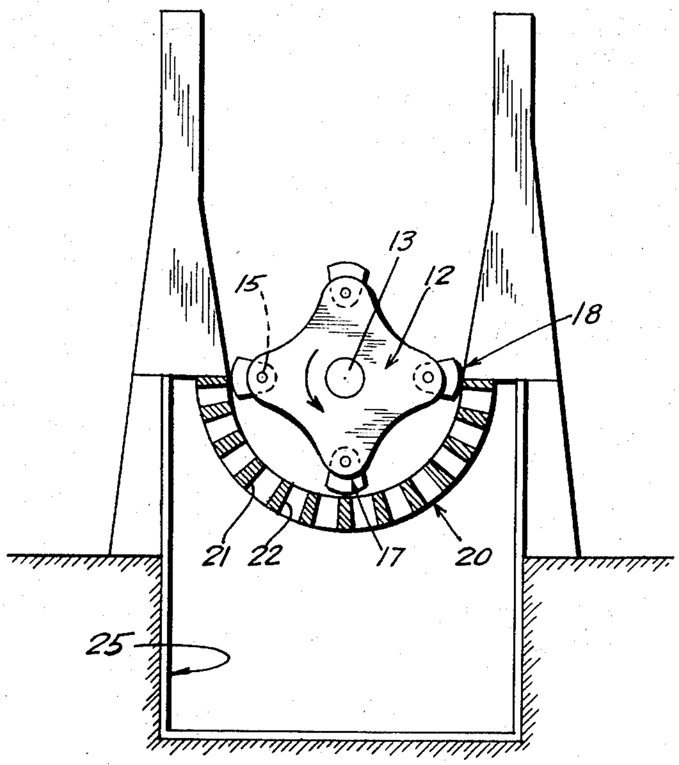
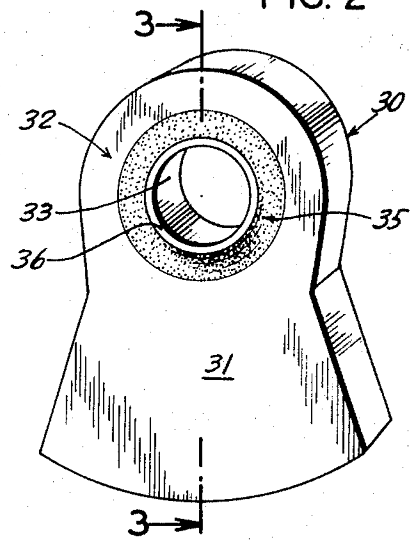


FIG. 1

FIG. 2



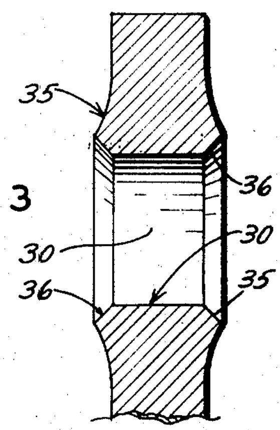


FIG. 3

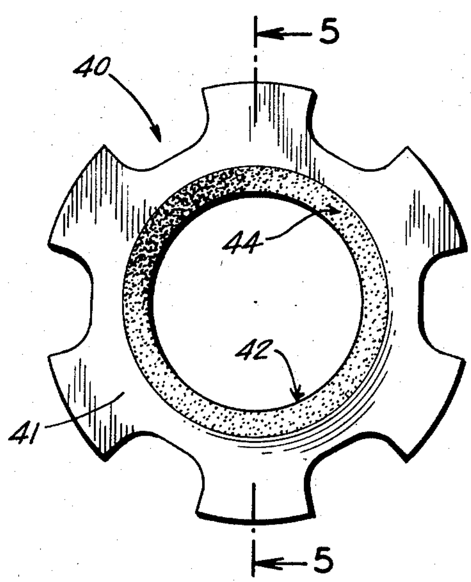


FIG. 4

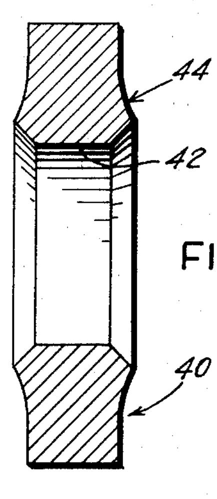


FIG. 5

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IMPROVED HAMMER FOR HAMMER MILLS

This invention relates to the construction of a hammer for installation in a hammer mill.

The typical hammer mill, used to comminute rocks, scrap metal chunks and the like, includes a large rotary driven ring or disc supporting circumferentially spaced rods each of which fits the eye of a hammer to support the hammer and whirl it with the ring. The working forces are of large order. Resultantly, there is a pronounced tendency for the eye of the hammer to stretch due to the play of centrifugal forces between the hammer eye and its support rod. Thus, the eye is distorted, the hammer wobbles, vibrations ensue, and the mill must be shut down for hammer replacement.

The problem is especially acute with hammers of austenitic manganese steel, because of its inherent ductility.

The problem has been known for more than 40 years. In U.S. Pat. No. 1,760,097 (filed in 1928) it is stated "Oscillation of the hammers upon the rod on which they are pivoted causes wear in the eye and on the rod". The patentee proposed that the problem be solved by altering the center of gravity. He did this by enlarging the hammer head, but did not observe that the additional weight so added produces more strain on the mill as can be well imagined from the increased weight at the end of the whirling hammer. Under my invention, there is no change in the center of gravity and essentially no increased strain on the mill, and the achievement of this is an object of the present invention.

The very nature of austenitic manganese steel contains the clue to avoiding eye distortion of a hammer. The clue is that if the hammer is cast from austenitic manganese steel, and if it so cast as to present a thickened ring or pad of extra metal surrounding the extremities of the eye, the extra metal may be work hardened. The effect is an eye which is hardened at the extremities. Since the extremity is hardened, the metal resists flow to that extent, which is to say that stretching is inhibited proportionally. It is, therefore, a further object of the present invention to cast a hammer from austenitic manganese steel with an integral ring of extra metal at each end of the eye, the ring being work hardened.

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

In the drawing:

FIG. 1 is a sectional view, partly diagrammatic, of a typical hammer mill;

FIG. 2 is a perspective view of one form of hammer constructed in accordance with the present invention;

FIG. 3 is partial sectional view of the hammer shown in FIG. 2;

FIG. 4 is a plan view of another form of hammer constructed in accordance with the present invention; and

FIG. 5 is a sectional view of the hammer shown in FIG. 4.

FIG. 1 shows a typical hammer mill wherein rocks, scrap metal chunks and other burden of large size is to be crushed to a smaller size. In doing this, resort is had to a hammer support ring **12** fixed to a drive shaft **13** for rotary movement.

The support ring or disc **12** carries four hammer support rods **15** each supporting, pivotally, a hammer **17**.

These hammers **17** are whirled or revolved within the mill. The impacting face **18** of each hammer follows a circular path opposite a grate ring **20** characterized by spaced bars or ribs **21**, the spacing therebetween defining slots **22** through which the comminuted material is discharged for collection in the discharge bin **25**.

As noted above, the hammers are pivotally mounted on the support rods or shafts **15** so that there may be free swinging movement of the hammers in the course of operation. This is always so. The working forces involved are of very high order, especially the play of centrifugal forces between the support rod **15** and the eye or opening in the hammer shaft enabling the hammer to be mounted thereon. The forces are so large that stretching or distortion of the eye is a frequent, and in fact normal, reason for shutting down the mill to replace the hammers. It can be readily visualized that when the eye is distorted, the hammer will wobble producing unacceptable vibrations within and strain on the mill.

Hammers of the kind involved may be of variant shape. One such form, as shown at **30** in FIG. **2**; geometry is unimportant, but for purposes of definition the hammer **30**, under the present invention, is cast entirely of austenitic manganese steel and includes a hammer head **31** and a shank **32**. The shank is formed with a relatively large eye **33** for the purpose mentioned above.

Ordinarily hammers of the kind involved, cast from austenitic manganese steel, will have a Brinell hardness of **180-220** BHN and a nominal yield strength of about **50,000** psi, too low to preclude stretching which progresses to a degree leading to failure at the eye.

Under the present invention, the hammer is cast entirely of austenitic manganese steel with thickened rings or pads **35** continuous about the end openings of the eye **33**. The rings **35** project axially from the eye, characterizing the thickened section, which in plan has the shape of torus.

After the casting has been taken from the heat treating furnace the thickened pads or rings **35** are work hardened, as by hammering, to a BHN value of 440–480, with corresponding increase in yield strength. During work hardening, some metal from the pads may flow into the interior of the eye, but any unacceptable dimension can be restored by a grinding operation typically performed on manganese steel.

Preferably the inner diameter of the extra metal rings is chamfered at **36** to provide an outwardly sloped radial face which facilitates application of the hammer blows, since the important aspect is that the areas around the ends of the eye be hardened and not necessarily the interior of the eye. Resultantly the effect is that the end openings of the eye **33** have approximately double the hardness of the rest of the casting. There is in effect scarcely any allowance for metal flow or ductile distortion, so that the integrity of the eye diameter remains virtually constant. On the other hand, I retain all of the advantages of unhardened austenitic manganese steel, at the impacting face and sides of the hammer, known to provide distinctive wear life over metals having higher strength.

Another form of hammer, a so-called ring hammer suitable for use, is identified by reference character **40** in FIG. **4.** This is for the purpose of projecting the realization that hammer mill hammers are of variant geometry. The hammer **40** is one piece, cast entirely of austenitic manganese steel, and lugs **41** represent a plurality of hammer elements. Again, the eye **42,** at the extremities, is cast with rings **44** of extra metal of the form described above, work hardened for the purpose already explained.

I claim:

1. In a hammer for a hammer mill wherein the hammer includes a shank formed with an eye enabling the hammer to be mounted on a supporting rod for revolving movement within the mill, the improvement wherein the hammer is cast from austenitic manganese steel metal with a ring of extra integral metal surrounding and projecting axially of the eye on each side of the hammer, the extra metal being work hardened to a BHN hardness value which is approximately twice the hardness value of the remainder of the hammer to thereby inhibit stretching due to centrifugal forces exerted on the eye when the hammer is revolved.

2. A hammer according to claim **1** in which the extra ring of metal is chamfered at the eye diameter to provide an outwardly sloped radial face to facilitate work hardening.

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