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Miller

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[54] **LINERS FOR SHREDDING MACHINES**

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[73] Assignee: **American Pulverizer Company**, St. Louis, Mo.

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[52] **U.S. Cl.** ..... **241/189 R**; 241/285 A

[51] **Int. Cl.**[2] **B02C 13/09**

[58] **Field of Search** ..... 241/189 R, 207, 285 A

[56] **References Cited**

UNITED STATES PATENTS

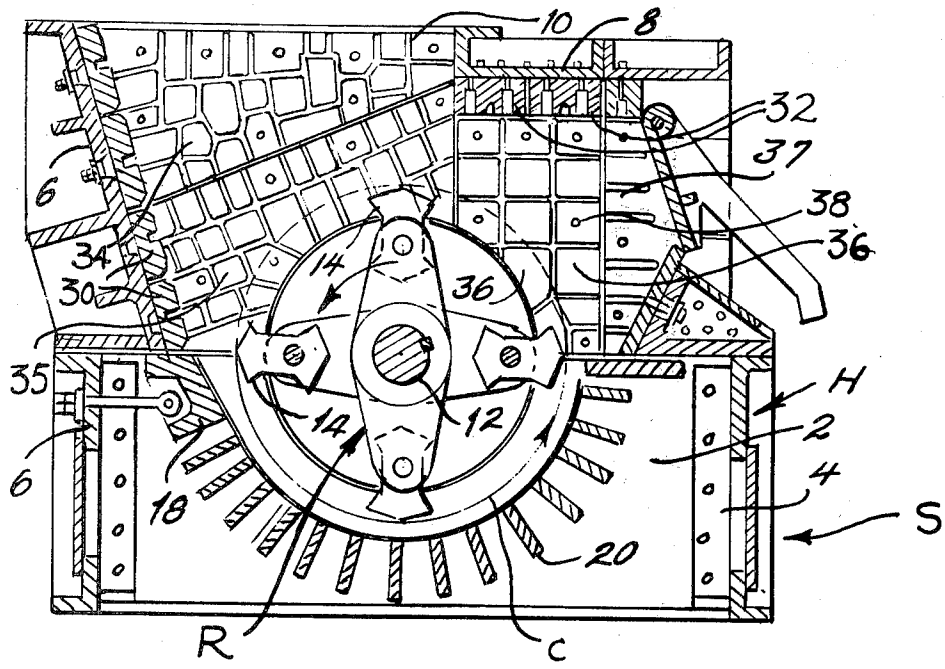
2,185,331	1/1940	Conway	241/189 R X
2,463,223	3/1949	Verch	241/189 R X
3,623,674	11/1971	Alt	241/189 R
3,722,805	3/1973	Strom	241/189 R X
3,850,376	11/1974	Mertz	241/207

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Assistant Examiner—Howard N. Goldberg
Attorney, Agent, or Firm—Gravely, Lieder & Woodruff

[57] **ABSTRACT**

A manganese steel liner for a reducing machine has antipeening slots opening out of the working surface thereof. When the metal of the liner experiences plastic flow at the working surface as a result of reduced fragments impinging against the working surface, the metal will flow into the slots without creating excessive stresses in or substantial deformation of the liner.

5 Claims, 6 Drawing Figures



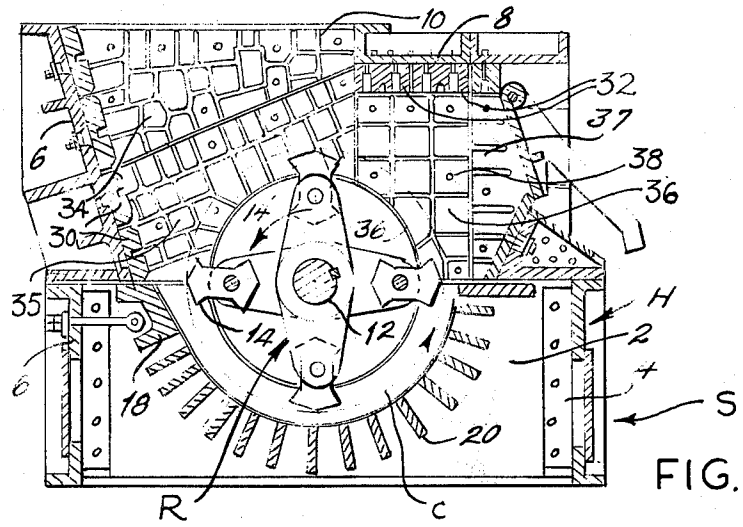


FIG.1

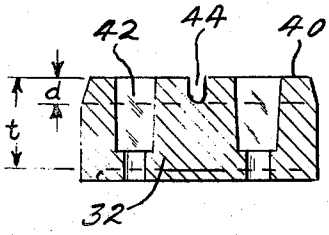


FIG.5

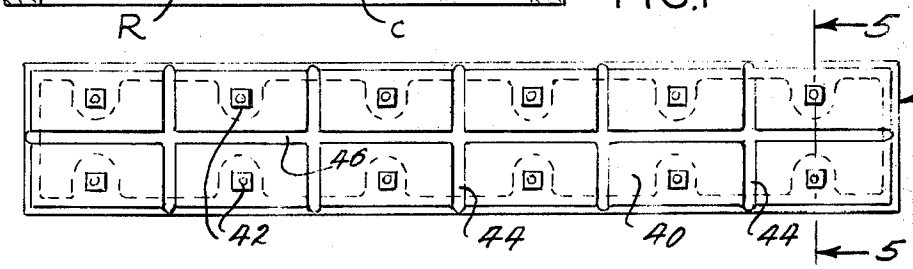


FIG.4

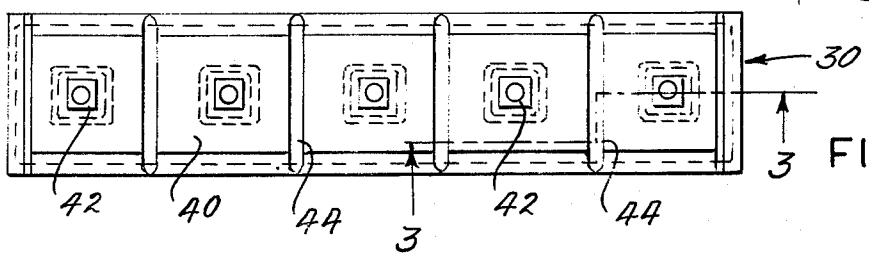


FIG.2

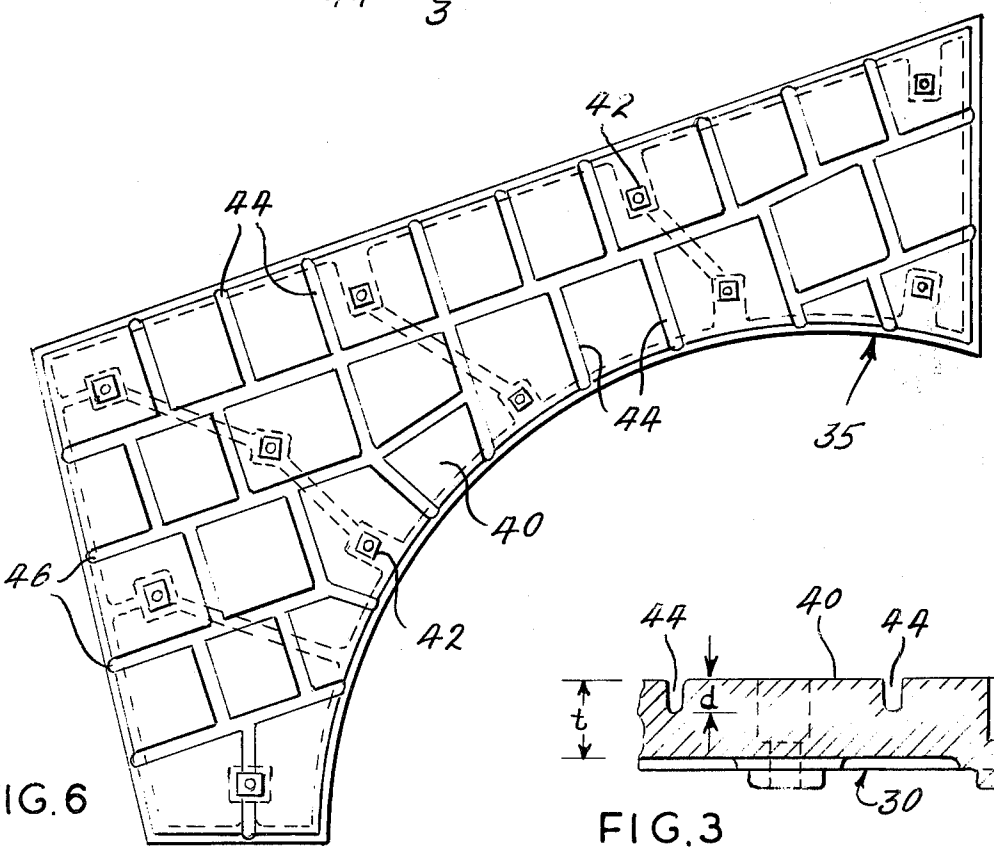


FIG.6

FIG.3

LINERS FOR SHREDDING MACHINES

BACKGROUND OF THE INVENTION

This invention relates in general to reducing machines and more particularly to liners for reducing machines.

The typical metal shredding machine has a housing and a rotor which revolves in the housing. Scrap metal is fed into the housing and torn into small fragments by hammers on the rotor. The rotor imparts high velocities to these fragments and to prevent the fragments from damaging the housing walls, the walls are protected with replaceable liners.

The most commonly used liner material is manganese steel, and when cast into relatively thin plates this material is ideally suited for use in relatively small machines such as those used to shred steel turnings, metal cans, sheet metal or aluminum castings. In particular, manganese steel is extremely tough and can withstand high impacts without cracking. Also, the metal fragments impinging against the liner cold work it and in so doing create plastic flow. This tends to harden the steel at its exposed surface, leaving the liner with a hard working surface and a tough core. Thus, the rate of wear decreases with use.

The work hardening characteristics of manganese steel create difficulties where that steel is used in extremely thick liners, such as those required for large shredders capable of shredding automobiles, appliances, and the like, due to the extremely large amount of plastic flow. Indeed, the stresses set up within the top 2 to 3 inches of such casting may actually cause the top 2 to 3 inches to separate from the rest of the liner. Moreover, the surface peens or mushrooms over its edges, but the edges are usually confined quite closely, so as a result the casting bows inwardly toward the rotor. This in turn contributes to cracking and also causes the bolts which hold the liner against the housing to fail.

SUMMARY OF THE INVENTION

One of the principal objects of the present invention is to provide a manganese steel liner which can withstand severe impacts without failing. Another object is to provide a liner of the type stated which may be used in extremely thick configurations in heavy duty shredding machines. A further object is to provide a liner of the type stated which will not undergo a substantial increase in width when subjected to severe impacts. Still another object is to provide a liner of the type stated which is ideally suited for use in shredding machines capable of reducing automobiles, appliances, and other large metal objects. These and other objects and advantages will become apparent hereinafter.

The present invention is embodied in a liner having voids opening out of its working surface. As the metal of the liner undergoes plastic deformation, it flows into the voids. 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 and letters refer to like parts wherever they occur:

FIG. 1 is a transverse sectional view of a shredder provided with liners constructed in accordance with and embodying the present invention;

FIG. 2 is a plan view of one of the spout liners in the shredder;

FIG. 3 is a sectional view taken along lines 3—3 of FIG. 2;

FIG. 4 is a plan view of a top liner;

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 4; and

FIG. 6 is a plan view of a side liner.

DETAILED DESCRIPTION

Referring now to the drawings (FIG. 1), S designates a shredder including a housing H and a rotor R which revolves in the housing H. The housing H has spaced apart sidewalls 2, a back wall 4, a front wall 6, and a top wall 8.

Scrap metal or other material to be shredded is fed into the housing H through an upwardly opening spout or inlet 10 located above and generally to one side of the rotor R. The rotor R includes a rotor shaft 12 and hammers 14 which pivot relative to the shaft 12, but due to the centrifugal forces on them, normally project outwardly and define a hammer circle C. Within the inlet 10, the hammer circle C downwardly converges with the front wall 6 of the housing H. Moreover, the hammers 14 move toward the front wall 6 as they pass by the inlet 10. At the lower end of the inlet 10, the housing H supports a grinding plate 18, and beyond the grinding plate 18 it is provided with a plurality of grates 20 having openings through which shredded material is discharged. The grinding plate 18, and the grates 20 together occupy an arc which extends about 180° along the hammer circle C.

The metal or other material to be shredded is introduced into the housing H through the inlet 10, and as the hammers 14 pass by the inlet 10, they tear fragments from the scrap. These fragments are reduced still further along the grinding plate 18 and grate 20. Most of the fragments are discharged through the openings in the grate 20, leaving the grate 20 at a high velocity. However, some of the fragments, particularly the oversized ones, are carried beyond the grate and hurled with great velocity toward the top wall 8 of the housing H.

To prevent the scrap from damaging the housing H due to high forces applied to it at the inlet 10, the front wall 6 at the inlet 10 is covered with spout liners 30. Likewise, to protect the top wall 8 from the severe impacts of the fragments propelled upwardly beyond the grate 20, the top wall 8 is covered with top liners 32. Also, the sidewalls 2 are protected with side liners 34, 35, 36 and 37. The liners 30, 32, 34 and 36 are held in place with bolts 38.

All of the liners 30, 32, 34, 35, 36 and 37 are castings with the cast metal being known as manganese steel. The specific designation for standard austenitic manganese steel with a manganese content of from 11 to 14 percent manganese and about 1 percent carbon is A-128-64, and is commonly referred to as Hadfield Manganese steel, or simply, manganese steel. Some specific alloys are made with small amounts of chrome and/or molybdenum and may also be known as chrom-manganese steel or moly-manganese steel or MOL.

The spout liners 30 which are located in the inlet 10 (FIGS. 2 and 3) are representative of the liners 30, 32, 34, 35, 36 and 37. Each spout liner 30 extends the

width of the front wall **6** and has a working surface **40** presented toward the rotor R. The liner **30** is further provided with bolt holes **42** for receiving the bolts **38.** Actually, the holes **42** are counterbored from the working surface **40** so that the heads of the bolts **38** are set as close to the front wall **6** as possible. In addition, the liner **30** has antipeening grooves or slots **44** which open inwardly toward the rotor R, that is they open out of the working surface **40** which is exposed to the fragments propelled away from the rotor R and resist forces applied to the scrap by the rotor R. The slots **44** are parallel and extend transversely of the liner **30** the full width thereof. Hence, the slots **44** are oriented in the vertical direction. The bolt holes **42** are centered between the slots **44.**

The depth *d* of each slot should be between 25 and 50 percent of the total thickness *t* of the liner **30** with a depth of 33 percent being preferred (FIG. **3**). Usually the thickness *t*, which is the distance from the working surface **40** to the major surface area facing the front wall **6** of the housing H, is about 7 inches. Mounting bosses and locating ribs are excluded in measuring the thickness *t*. The side surfaces of each slot **44** are tapered slightly such that they diverge from the bottom of the slot **44,** whereas the bottom is curved. The slots **44** should be wide enough to occupy between 15 and 25 percent of the working surface **40** out of which they open. In other words, if the width of the liner **30** is *W* and its length is *l*, the area of the outwardly opening ends of the slots **44** should be 15 to 25 percent of (*w* ¼ *l*). The volume occupied by the slots **44** should be between 3 and 7 percent of the total volume of the liner **20** and should preferably be 5 percent. The area of the working surface **40** between any two adjacent slots **44** should not exceed 400 in.² and should preferably be between 100 in.² and 250 in.², including the area of the bolt holes **42.**

Wider liners such as the top liners **32** (FIGS. **4** and **5**) in addition to the transverse antipeening slots **44,** may be provided with longitudinal slots **46.** The longitudinal slot **46** of each top liner **32** extends the full length of the liner **32** and possesses the same depth and cross sectional configuration as the transverse slots **42.** The top liners **32** are also about **7** inches thick.

Where a liner is quite wide, such as the side liners **34, 35,** or **36** (FIG. **6**), it should have a plurality of both transverse antipeening slots **44** and longitudinal antipeening slots **46** which intersect and form a grid pattern. The top side liners **34, 35** and **37** are about 2 inches thick.

In use, the liners **30, 32, 34, 35, 36** and **37** do not develop stresses severe enough to cause the metal near the working surface **40** to break away from the core metal, nor do they undergo substantial deformation. Thus, they have a much longer service life. In particular, when the metal of the liner **30** tends to flow as a result of being subjected to the forces applied by the scrap when acted upon by the rotor R, the flow is into the antipeening slots **44.** The flow from adjacent areas may gradually fill the slots **44,** but the work hardened metal at the working surface **40** still retains its continuity with the core of the liner **30** which is the portion adjacent the front wall **6.** Moreover, the liner **30** does not experience any significant tendency to lengthen, and as a result it does not bow toward the rotor R. This in turn keeps the bolts **38** in tact. The liners **32, 34, 35** and **37** function in the same manner, only the metal at the working surface **40** can flow into the longitudinal slots **46** also.

Generally speaking the antipeening slots in the liners need not form any pattern. The antipeening slots should however

1. open toward the direction from which the fragments come or impact forces are applied so that they open out of the working surface area against which the fragments impinge;

2. having a depth between 25 and 50 percent of the thickness of the liner;

3. border or enclose a portion of the working surface not less than 50 in.² and not greater than 400 in.²;

4. occupy between 3 and 7 percent of the total volume of the liner;

5. occupy between 15 and 25 percent of the working surface out of which they open.

In measuring the thickness of a liner, small mounting bosses, peripheral ribs, and similar protrusions from the major surface area at the back of the liner should not be considered. Likewise, shallow recesses opening out of the back of the liner should not be computed. Thus, the thickness is the distance from the major surface area at the rear of the liner to the working surface **40.** In computing the total area of the working surface, the areas of the outwardly opening ends of the slots **44** and **46** and of the bolt holes **42** should be included. In other words, the area of the working surface on a rectangular liner is for all intents and purposes its length times its width. In computing the surface area bordered or enclosed by two or more slots, the areas of the bolt holes are included in that surface area.

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 reducing machine including a housing having an inlet, a grate in the housing, and a rotor which revolves in the housing above the grate and about a horizontal axes so as to engage material introduced into the housing through the inlet to reduce that material to fragments of smaller size which will pass through the grate, the improvement comprising a liner attached firmly to the housing above the grate and outwardly from the rotor such that it is between the housing and rotor so as to protect the housing from fragments propelled by the rotor, the liner being formed from steel which tends to flow upon being subjected to impacts and having a working surface presented toward the rotor, the liner further having a plurality of grooves which open out of the working surface, the grooves having curved inner ends and further being tapered outwardly from their curved inner ends so that the grooves have their greatest width at the working surface, the depth of each groove being between about 25 and 50 percent of the thickness of the liner at the groove, and the area bordered by two or more grooves being between about 50 in.² and 400 in.², whereby the metal of the liner will flow into the grooves as it undergoes plastic deformation and will not create excessive stresses or substantially deform the liner as a whole.

2. The structure according to claim **1** wherein the volume of the groove is between 3 and 7 percent of the total volume of the liner (groove included). included.

3. The structure according to claim 1 wherein the metal from which the liner is formed is manganese steel.

4. A liner according to claim 1 wherein the grooves intersect to form a grid pattern.

5. The structure according to claim 1 wherein the area of the outwardly opening ends of the grooves is between about 15 and 25 percent of the total area of the working surface for the liner (groove area included in total working surface area).

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