

Dec. 9, 1969

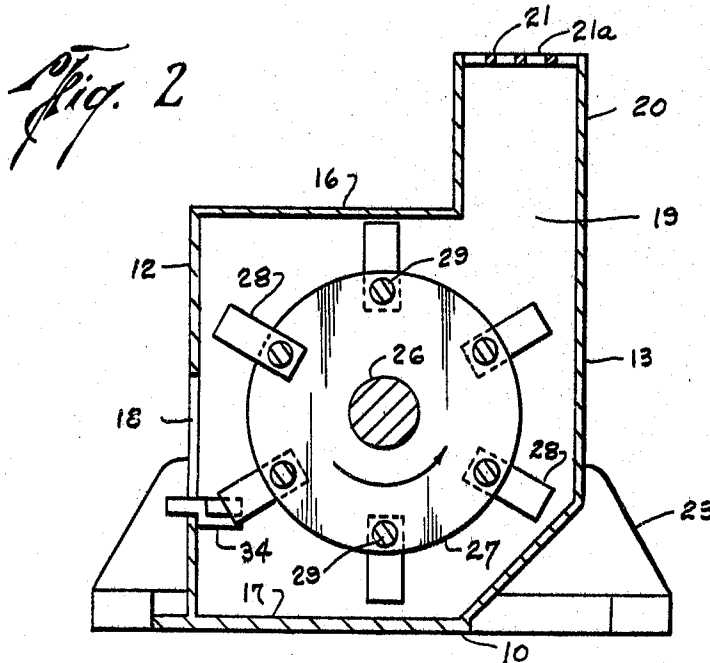
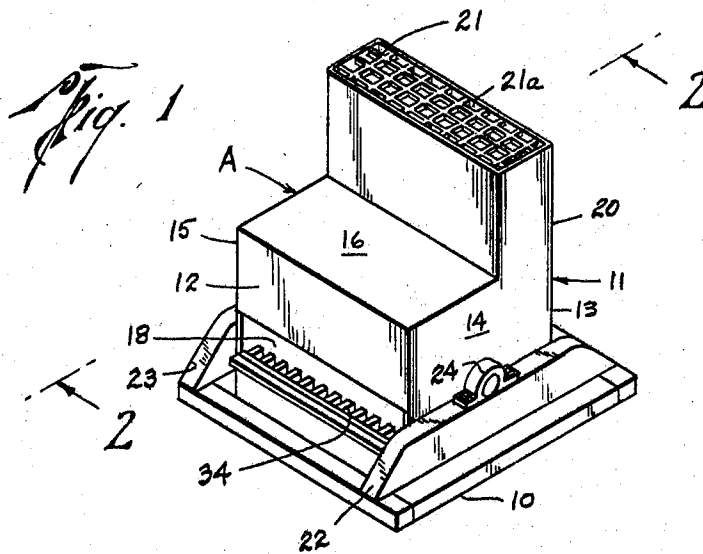
A. S. NEWELL

3,482,788

HAMMER MILLS

Original Filed March 18, 1965

2 Sheets-Sheet 1



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HAMMER MILLS

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2 Sheets-Sheet 2

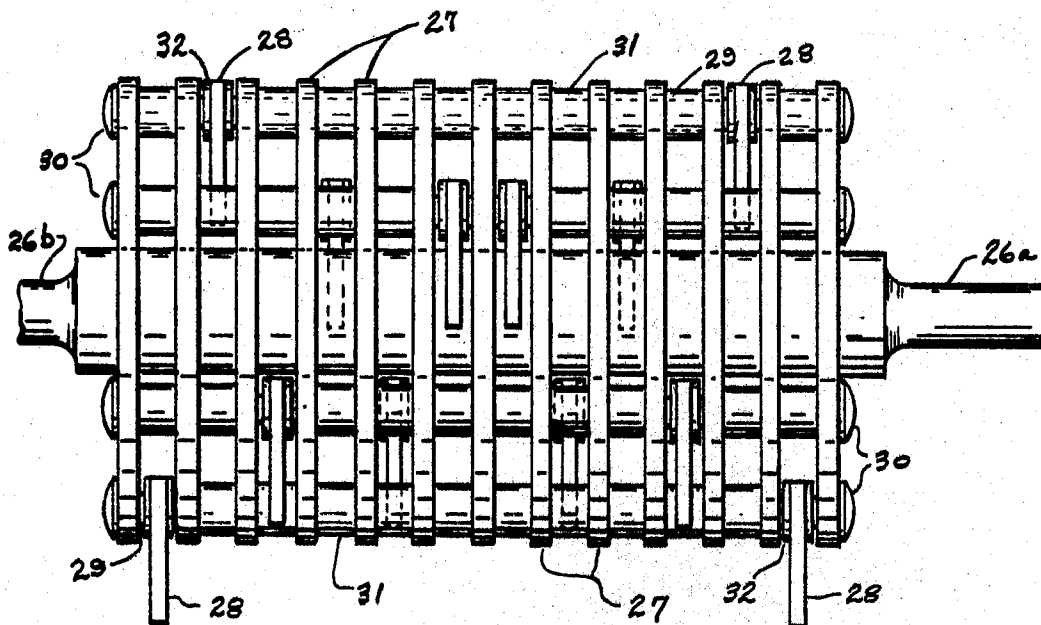


Fig. 3

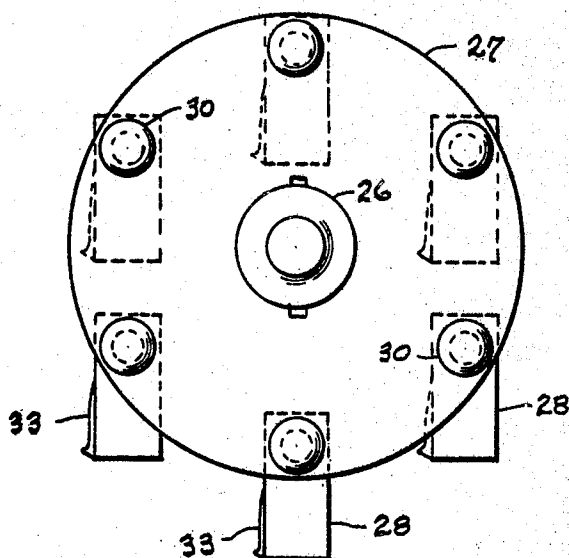


Fig. 4

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3,482,788

HAMMER MILLS

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Continuation of application Ser. No. 440,701, Mar. 18, 1965. This application July 1, 1968, Ser. No. 752,426

Int. Cl. B02c 13/04, 17/02

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8 Claims

ABSTRACT OF THE DISCLOSURE

A hammer mill for treating scrap metal including a rotary hammer means for delivering impact blows to the scrap metal and having a discharge grate disposed across the generally upwardly directed outlet of the mill, the grate being located substantially perpendicular to a line tangential to the path of rotation of the hammer means.

This application is a continuation of my copending application, Ser. No. 440,701, filed Mar. 18, 1965, now abandoned.

This invention relates to an improvement in hammer mills, and more particularly it relates to hammer mills for use in treating scrap metal.

It is an object of this invention to provide a hammer mill which is suitable for use in treating scrap material, such as sheet metal contained in automobile bodies and large appliances, by subjecting such material to the cutting, shredding and sizing blows of a series of hammers in the mill. The value of the scrap metal is increased by such treatment since it is at least partially cleaned by the removal of undesirable materials, such as paints, clinging to the scrap metal while changing it to a form and size which makes it easier to both handle and use.

It is another object of this invention to provide a hammer mill of the character described wherein the grate through which the treated material must pass to leave the hammer mill is located at or near the top of the mill and the material is thrown upwardly against the grate by the action of the hammers. In hammer mills of the prior art, the discharge grate has been located at or near the bottom of the hammer mill so that the material falls against the grate due to gravity without necessarily being struck by one or more of the hammers. This latter arrangement increases the possibility that part of the material will find its way to and through the discharge grate without having been properly treated by the hammers.

Another object of this invention is to provide a hammer mill of the character described which includes a gathering box through which the treated material must pass before reaching the discharge grate, the gathering box being of sufficient length to function as a means for guiding or directing the treated material against the grate in the desired path.

Another object of this invention is to provide a hammer mill of the character described which includes a series of anvils adjacent the inlet to the hammer mill, the stationary anvils being so located and arranged that the hammers pass between adjacent anvils whereby the material to be treated is subjected to a shredding, tearing and cutting action due to the cooperation of the hammers and anvils as said material is fed into the mill.

Another object of this invention is to provide a hammer mill of the character described wherein the hammers are readily replaceable after such hammers have been worn out due to use.

Yet another object of this invention is to provide a hammer mill of the character described wherein the wear surface of the hammers is of the built-up type so that such wear surface may be replaced after it is worn away.

Other objects will hereinafter appear in the following description of one embodiment of the invention.

In the drawings:

FIGURE 1 is an isometric view of a hammer mill constructed in accordance with this invention,

FIGURE 2 is a vertical section taken along line 2-2 of FIGURE 1,

FIGURE 3 is an illustration of the shaft, disc and hammer assembly of such a mill removed from the mill, and

FIGURE 4 is an end view of the shaft, disc and hammer assembly shown in FIGURE 3.

In the drawings the letter A designates a hammer mill which includes a base 10 constructed of suitable structural members, such as I-beams, upon which the housing 11 rests. The housing 11 is fabricated from steel plates of desired strength welded together to form a generally box-like structure having a front side 12, back side 13, ends 14 and 15, top 16, and bottom 17.

An inlet 18 is provided in the front 12 through which the scrap material to be treated is introduced into the housing 11. After having been subject to the action of the hammers within the mill, the treated material exits from the housing 11 through a discharge opening 19 which is preferably located in the top 16 of the housing 11 at or near the back side 13.

A gathering box or portion 20 is disposed about the outlet 19 and extends in a direction away from the housing 11. As is discussed more fully hereinafter, the gathering box 20 functions to insure that the treated material after passing through the opening 19 is traveling in the proper direction.

A discharge grate 21 is removably secured to the end of the gathering box 20 opposite the opening 19. The grate 21 has a plurality of openings 21a through which the material treated by the hammer mill must pass in order to escape from the action of the hammer mill. The treated material cannot escape from the hammer mill until each piece within the mill is small enough to pass through one of the openings 21a in the grate 21. Thus, the size of the treated material may be controlled or varied by simply varying the size of the openings 21a in the grate 21 or by utilizing different discharge grates, each of which has openings of a different size.

If desired, a deflector (not shown) may be placed over the grate 21 so as to deflect or change the direction of travel of the treated material discharging through the grate 21.

The base 10 includes support members 22 and 23 located at the ends 14 and 15, respectively, of the housing 11. The support members 22 and 23 support the bearings 24 near the center of each end 14, 15. The bearing 24 on the support member 23 is not illustrated in the drawings since it is like the illustrated bearing 24 on the support member 22.

Referring now to FIGURES 3 and 4, a shaft 26 (which is located within the housing 11) has its end portions 26a and 26b extending through the end walls 14 and 15, the end portions 26a and 26b being rotatably mounted in and supported by the bearings 24. A series of discs 27 are secured to the shaft 26 for rotation therewith, the shaft 26 passing through the center of each disc 27. As illustrated in FIGURE 3, the discs 27 are parallel to and spaced from one another along the longitudinal axis of the shaft 26. The discs 27 are preferably cut from a steel plate of suitable thickness in a circular shape so that the discs have the same diameter to insure that the shaft and discs are dynamically balanced when rotated.

The hammers 28 are rotatably mounted at one end thereof on pins 29 which extend through and are supported by the discs 27 near the periphery of such discs. Preferably, each pin 29 extends through the series of discs

27 parallel to the axis of rotation of the shaft 26 and is held in place by a suitable cap 30 secured to each end of the pins 29. The hammers 28 may be easily replaced by removing one of the caps 30 and withdrawing the pin 29.

Spacing sleeves 31 are provided on the pins 29 between the discs 27 to help maintain the proper spacing between the discs 27. Washers 32 may be used adjacent the hammers 28 to partially fill the space between adjacent discs 27 and to provide a suitable wear surface for the moving frictional contact which would otherwise occur between the discs 27 and hammers 28 when the shaft 26 is rotated.

As has been noted, the hammers 28 are rotatably secured to the pins 29 at one end of each hammer 28, the other end of each hammer being free. It is this free end of each hammer 28 which strikes the material being treated within the housing 11 a yielding blow to thereby cut, shred, tear such material, as well as reduce it in size. Thus, a large piece of sheet metal, such as an automobile body or fender, fed into the hammer mill is separated into a number of small pieces which are further reduced in size and densified by the blows of the hammers 28.

The free or striking end of each of the hammers 28 is provided with a built-up striking surface 33 which is gradually worn away as it strikes the material in the mill. The striking surface 33 is preferably deposited on each hammer 28 by fusion or welding. The striking surface should be of an impact and abrasive resisting steel alloy containing, for instance, manganese, chromium nickel and silicon, whereas the hammer itself may be made of a high carbon steel. Of course, to be effective, the striking surface 33 must be on the leading or striking edge of each hammer 28, that is, the edge which faces in the direction of rotation of the shaft 26 and discs 27.

Stationary hammers or anvils 34 are disposed just inside of the front side 12 of the housing 11 along the lower edge of the inlet 18. The anvils 34 are spaced apart sufficiently and so arranged with respect to the hammers 28 so as to permit the hammers 28 to pass between adjacent anvils as illustrated in FIGURE 2.

A suitable power source (not shown), such as an electric motor or internal combustion engine, is connected to shaft 26 for rotationally driving the shaft 26, discs 27, and hammers 28. The shaft 26 should be rotated at the proper speed to produce sufficient centrifugal force to cause the hammers 28 to extend radially outwardly from the shaft 26 and discs 27 as illustrated in FIGURE 2. The power source also provides the necessary energy for accomplishing the desired treatment of whatever material is fed into the mill.

When the hammer mill A is operating, the shaft 26, discs 27, and hammers 28 are rotated in a counterclockwise direction as viewed in FIGURE 2. The hammers are in the extended or striking position as shown in FIGURE 2 and as distinguished from the stationary position illustrated in FIGURES 3 and 4. As the material to be treated is fed into the hammer mill through the inlet 18, it is first subjected to the cooperating action of the hammers 28 and anvils 34. The hammers 28 in passing between the anvils 34 cut, tear and shred the feed material into comparatively smaller pieces, the size depending on many variables such as the rate of feed, size and spacing of the hammers and anvils, and the speed of rotation of the shaft 26.

After being subjected to the coaction of the hammers 28 and anvils 34, the pieces either fall or are deflected towards the bottom 17 of the housing 11 when struck by the hammers 28. So long as the pieces remain in the housing 11, they are subject to repeated blows by the hammers 28. These blows knock any foreign material, such as paint, loose from the pieces and cause the pieces to be "balled up," that is, the hammer blows form the pieces into a more or less ball shape as distinguished from a flat, strip-like shape.

As the pieces are repeatedly struck by the hammers 28, such pieces are thrown or knocked upwardly along the

back side 13 towards the gathering box 20. If a particular piece is traveling in the proper direction at sufficient speed, it will pass through the grate 21 if it is small enough to pass through one of the openings 21a. If the piece is too large or does not have sufficient velocity or strikes the grate 21 at an angle, it may fall downwardly into the mill where it will be subjected to further blows of the hammers. This action is repeated until all of the material is discharged through the grate 21.

As has been noted, if a piece of the material strikes the grate 21 at an oblique angle, it will not pass through an opening 21a in the grate even though the piece is of the proper size. The gathering box 20 tends to reduce this problem by functioning as a means for directing the pieces toward the grate 21 at the proper angle, that is, perpendicular to the openings 21a in the grate. To accomplish this function the walls of the gathering box 20 are perpendicular to the grate 21 so that if a piece of the material is traveling in a path other than parallel to the walls of the gathering box it will strike such walls and tend to be deflected in a direction parallel to such wall, thus reducing the possibility of the piece striking the grate at an angle other than perpendicular to the openings through the grate.

As illustrated in FIGURE 2, the inlet 18, opening 19, and direction of movement of the hammers 28 are so related that the hammers 28 first pass downwardly across the inlet 18 and between the anvils 34, then move from the front side 12 along the bottom 17, and upwardly along the back side 13. The opening 19, gathering box 20 and grate 21 are located in the top 16 near the back side 13 so that they are above and in the line of travel of any piece of material which has been struck by one or more of the hammers 28 and knocked in a more or less upwardly direction as the hammers move along the bottom 17 and up the back side 13. If the direction of rotation of the shaft 16 was reversed, the pieces of material within the housing 11 would be deflected away from rather than toward the opening 19, and the possibility of a piece of the material being deflected toward and through the inlet by the hammers would be increased.

The hammers 28 are rotatably mounted on the pins 29 so that the hammers will strike a yielding blow against the material in the path of the hammers. After each hammer 28 has delivered its blow, it may then rotate about the pin 29 so that the material it struck has not been displaced so that the hammer may pass such material and strike it repeatedly after each revolution. This mounting prevents any jamming of the hammer mill or breakage of the hammers which would occur if the hammers were rigidly secured to the disc 27 or shaft 26.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departure from the spirit of the invention.

What is claimed is:

1. A hammer mill for treating scrap metal comprising:
 - a housing,
 - said housing having an inlet for introducing the scrap metal to be treated into the interior of said housing,
 - said housing having a generally upwardly directed outlet opening through which the treated scrap metal discharges from said housing,
 - hammer means pivotally mounted within said housing for rotation therein and for delivering repeated hammer blows to the scrap metal within said housing,
 - said hammer means being sufficient size and strength and being rotated at sufficient speed to reduce scrap metal fed into said housing to scrap metal pieces and for striking said scrap metal pieces to direct them toward said outlet opening with sufficient velocity for their discharge therethrough,
 - and a grate disposed across said outlet opening sub-

5

stantially perpendicular to a line tangential to the path of said rotation of said hammer means, said grate having openings therethrough to permit the discharge of the treated scrap metal pieces when said treated scrap metal pieces are properly sized to pass through said grate openings whereby scrap metal pieces not passing through said grate fall generally downwardly toward said hammer means and are then redirected toward said grate.

2. A hammer mill as set forth in claim 1 together with:

means disposed about and extending generally upwardly and away from said outlet opening for guiding and directing the scrap metal pieces passing through said outlet opening in the desired generally upwardly path, and said grate being located in said guiding and directing means remote from said outlet opening.

3. A hammer mill as set forth in claim 1 together with:

stationary anvil means disposed inside said housing and along the edge of said inlet farthest along the path of rotation of said hammer means whereby said hammer means first passes said inlet and then said anvil means.

4. A hammer mill as set forth in claim 1 wherein: said housing has a top and sides, said outlet opening is located in said top of said housing, and said inlet is located in the side of said housing farthest away from said outlet opening.

5. A hammer mill for use in treating scrap metal comprising:

a housing, said housing having an inlet for introducing scrap metal to be treated into the interior of said housing, said housing having a generally upwardly directed outlet opening through which treated scrap metal discharges from said housing,

a shaft rotatably supported within said housing, a plurality of discs rotatably mounted on said shaft in parallel spaced relationship,

each of said discs being disposed perpendicularly to said shaft whereby the periphery of said disc revolves in a single plane perpendicular to the axis of rotation of said shaft,

a plurality of hammers carried by said discs, one end of each said hammers being pivotally mounted between adjacent discs near the periphery of said discs,

the other end of said hammers extending radially outwardly from said discs when said discs are rotated for striking the scrap metal within said housing,

said hammers being of sufficient size and strength and being rotated at sufficient speed to reduce said scrap

6

metal to scrap metal pieces sufficiently small for discharge through said outlet opening and for striking said scrap metal pieces to direct them toward said outlet opening with sufficient velocity for their discharge therethrough,

and a grate extending across said outlet opening substantially perpendicular a line tangential to the path of said rotation of said hammer means,

said grate having openings therethrough to permit the discharge of the treated scrap metal pieces when said treated scrap metal pieces are properly sized to pass through said grate openings whereby scrap metal pieces not passing through said grate fall generally downwardly toward said hammer means and are then redirected toward said grate.

6. A hammer mill as set forth in claim 5 together with: a gathering box disposed about said outlet opening and extending outwardly therefrom,

said grate being located in said gathering box remote from said outlet opening whereby said gathering box forms a means for directing and guiding the pieces of discharging material passing through said opening towards said grate in the desired path.

7. A hammer mill as set forth in claim 5 together with: stationary anvils disposed inside said housing and along the edge of said inlet farthest along the path of rotation of said hammers whereby said hammers first pass across said inlet and then said anvils,

said anvils being spaced apart relative to said hammers so that each hammer passes between adjacent anvils without contacting any anvil.

8. A hammer mill as set forth in claim 5, wherein: said housing has a top and sides, said outlet opening is located in the top of said housing, and

said inlet is located in the side of said housing farthest away from said outlet opening.

References Cited

UNITED STATES PATENTS

1,699,849	1/1929	Lykken	241—49
1,807,923	2/1931	Lykken	241—189 X
1,931,555	10/1933	Mosley	241—49 X
2,068,383	1/1937	Lindgren et al.	241—86
2,233,728	3/1941	Bell	241—86 X
2,922,589	1/1960	Sheldon	241—197 X

FOREIGN PATENTS

22,097	8/1912	Great Britain.
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U.S. Cl. X.R.

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