ABSTRACT OF THE DISCLOSURE

Replaceable hammers each of which includes two portions, a body portion and a cap portion having overlapping arms joined by welding. The joined body and cap define therewithin a circular recess enabling the hammer to be pivotally mounted on a hammer mill disc shaft. When the hammer must be replaced, the old one is removed and a new body and cap are welded in place without the difficult and time-consuming task of removing the disc shaft. Furthermore, portions of the hammer surfaces are beveled to avoid the ill effects of impact swelting.

BACKGROUND OF THE INVENTION

The present invention relates to an improved hammer mill and to an improved hammer for such hammer mill.

Prior to the present invention, the hammers used in hammer mills for processing scrap metal such as automobile bodies have been installed by removing the disc shaft to remove the worn hammer and then reinterseting the disc shaft through the discs and a bore defined in the replacement hammer. After the hammer mill has been in use for any length of time, considerable difficulty is encountered in removing the disc shafts. Additional difficulty has been encountered in prior hammer mills because portions of the hammer are subject to deformation or swelting due to the impact of striking the material fed to the hammer mill. Since the hammers in this type hammer mill should pivot freely in the disc shaft, such swelting, particularly of the portions of the hammer coming into close spaced relationship to the discs, restricts the freedom of movement of the hammer on the disc shaft and may render the hammer inoperative.

OBJECTS

It is therefore an object of the present invention to provide an improved hammer for a hammer mill which may be installed on a disc shaft without removing the disc shaft from its operative position.

Another object is to provide an improved hammer for a hammer mill which has a greatly extended service life.

A further object is to provide an improved hammer for a hammer mill which minimizes the aforementioned impact swelting problem.

Still another object is to provide an improved hammer for a hammer mill which reduces scrap metal and which remains operative for extended periods of time.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages are herein after described and explained in relation to the preferred form of the present invention illustrated in the drawings wherein:

FIGURE 1 is an isometric view of a typical hammer mill in which the improved hammer of the present invention may be used.

FIGURE 2 is a vertical sectional view of such hammer mill taken perpendicular to the drive shaft and illustrates the hammer positions when the drive shaft is rotating.

FIGURE 3 shows the drive shaft, disc and hammer assembly used in such typical hammer mill with such assembly being shown in stationary position.

FIGURE 4 is an exploded perspective view of the preferred form of hammer of the present invention.

FIGURE 5 is a side elevation detail view of the assembled hammer shown in FIGURE 4.

FIGURE 6 is an end elevation view of the assembled hammer.

FIGURE 7 is an end view of the hammer and shaft.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The hammer mill A shown in FIGURE 1 is a typical hammer mill such as is disclosed in my prior pending application Ser. No. 440,701 filed Mar. 18, 1965, and now abandoned. As shown the hammer mill A 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 material to be treated, such as scrap metal, 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 removable 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 shown in the drawing but it is like bearing 24 on the support member 22 which is shown in FIGURE 1.

Referring now to FIGURES 1 and 3, a shaft 26 (which is located within the housing 11) has its end portions 26a, 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 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 with respect to the discs 27, preferably on disc shafts 29 which extend through and are supported by the discs 27 near the periphery of such discs. Preferably, each disc shaft 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 disc shafts 29. The hammers 28 are installed and removed as hereinafter described.

Spacing sleeves 31 are provided on the disc shafts 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 shaft 26 as hereinafter described 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 and tear such material, as well as reduce it in size. Thus, a large piece of steel, such as an automobile frame or body or portion thereof 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.

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.

The improved hammer 29 is best shown in FIGURE 4 to illustrate the structure of the body 35 and the cap 36. The body 35 defines the recess 37 at one end thereof and includes the arms 38 extending from the body 35 at each side of the recess 37. The recess 37 has a size and shape suitable for receiving a portion of one of the disc shafts 29. The body 35 is beveled at each end of the recess 37, which beveled portion is designated 39. The outer corners of each of the arms 38 are beveled as at 40. The cap 36 defines the recess 41 which has a size and shape suitable for engagement with a portion of one of the disc shafts 29. Arms 42 extend from cap 36 at each side of the recess 41 and are adapted on assembly with body 35 to be positioned between the arms 38 extending from body 35. The cap 36 is beveled at each end of the recess 41, which beveled portion is designated 43. The cap 36, when assembled with the body 35 around a disc shaft 29, is secured to the body 35 by any suitable means such as the welding which is designated 44. Thus, the two recesses 37 and 41 define a bore through which the disc shaft 29 extends. The recesses 37 and 41 should jointly be sized to coact with shaft 29 to provide the desired free swinging of the hammer 28.

While the impact, striking or head portion 45 of the hammer 28 may be of any desired size so long as it does not interfere with the free pivoting of the hammer 28, it is shown in the drawings as being of smaller width than the remaining portion of the body 35. This reduction in width of the head portion 45 allows considerable swelling or deformation causing a growth in width due to impact while assuring that such swelling does not cause the hammer 28 to be wedged in an inactive position between its adjacent discs. Additionally the bevels 39 and 43 at the ends of the recesses 37 and 41 prevents deformation of the hammer 28 against the disc shaft 29 due to wear and random impact with material in the hammer mill A. The beveled portions 40 on the arms 38 also compensate for impact swelling or deformation and prevent that portion of the hammer 28 from swelling into contact with its adjacent discs 27.

If desired, the striking or head portion 45 of the hammers 28 may be provided with a build-up striking surface (not shown). Such added striking surface is preferred to be an impact and abrasive resistant nickel alloy, containing, for example, managanese, chromium, nickel and silicon. Such surface is deposited on the leading or striking edge of the hammer 28 by fusion or welding.

When the hammer mill A is operating, the shaft 26, discs 27, and hammers 28 are rotated in a counter-clockwise direction as viewed in FIGURE 2. The hammer are in the extended or striking position as shown in FIGURE 2 and as distinguished from the stationary position illustrated in FIGURE 3. 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 hammer 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 21. 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 26 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 pivotally mounted with respect to the discs 27 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 its disc shaft 29 if the material it struck has not been displaced so that the hammer may pass such material and strike it repeatedly after each revolution. This pivotal mounting of the hammers 28 prevents any jamming of the hammer mill or breakage of the hammers which would occur if the hammers were rigidly secured with respect to the discs 27.

Whenever a new hammer is to be installed in the hammer mill A, the old hammer or one of the sleeves 31 are removed from the disc shaft 29 in the desired installation position and the two portions of the hammer 28 are assembled around the disc shaft 29 and welded together. By including the interlapping arms 38 and 42 and welding between such arms a stronger hammer is produced than without such arms.

The hammer of the present invention is constructed to avoid the usual problems of impact deformation or swelling and therefore provides a hammer having a much longer service life. By utilizing the two piece hammer construction of the present invention a hammer may be quickly and easily installed in a hammer mill without having to remove the disc shaft on which it is to be mounted. Additionally, this hammer may be mounted on a disc shaft which is other than cylindrical in shape, such a shaft could be journalled in the discs and adapted to pivot with the hammer.

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 I claim is:

1. A hammer for a hammer mill, comprising:
   a body having an impact portion at one end and defining an arcuate recess at the opposite end,
   a cap defining an arcuate recess,
   at least one arm extending from said body at each side of said recess defined by said body,
   said body and said cap when assembled defining a combined recess being circular in section and adapted to receive a shaft therethrough,
   the arms of said body and the arms of said cap being in overlapping relationship when said cap and said body are assembled, and
   welding between the overlapping arms of said body and said cap to secure said cap to said body in the assembled position.

2. The hammer according to claim 1 wherein:
   the outer corner of each of the arms extending from said body is beveled to minimize growth in width of said body resulting from impact deformation.

3. The hammer according to claim 1 wherein:
   two spaced apart arms extend from each side of said recess defined by said body,
   all of said arms being beveled along their exterior sides,
   the arm extending from each side of said cap being positioned between the two arms extending from the same side of said body,
   said welding being positioned between said arms along both sides of the arms extending from said cap,
   the outer bevels on said arms extending from said body being sufficiently large to allow deformation of said body due to impacts while maintaining said body width within preselected limits.

4. The hammer according to claim 1 wherein:
   said impact portion of said body has a reduced width.

References Cited

UNITED STATES PATENTS

2,287,735 6/1942 Halford.
2,429,410 10/1947 Esl 308—74 X
3,058,676 10/1962 Hermann 241—194 X
3,186,651 6/1965 Birolli 241—194 X

FOREIGN PATENTS

22,097 1911 Great Britain.

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