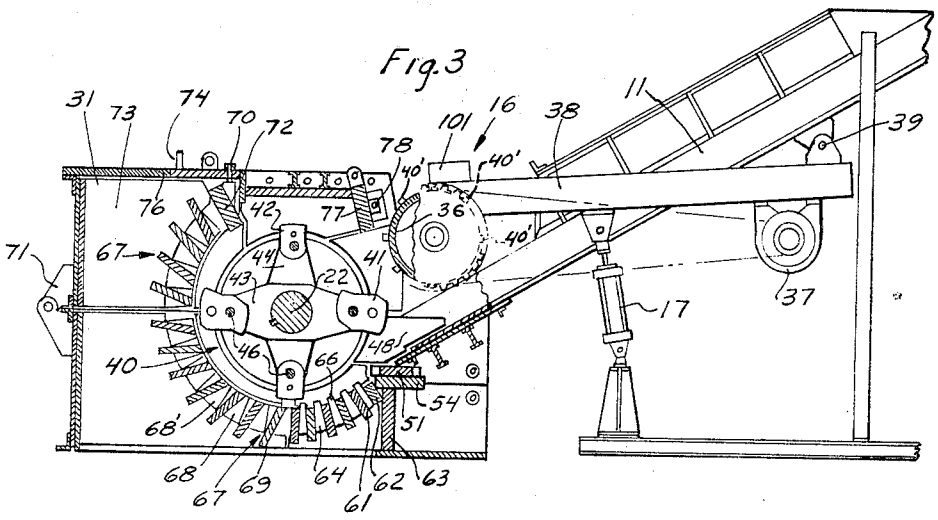
Jan. 13, 1970 T. A. OBERHELLMANN 3,489,078

SHREDDING TYPE HAMMERMILL WITH AUTOMOBILE-FLATTENING FEEDER

Filed Aug. 26, 1966 3 Sheets-Sheet 2

Fig. 3



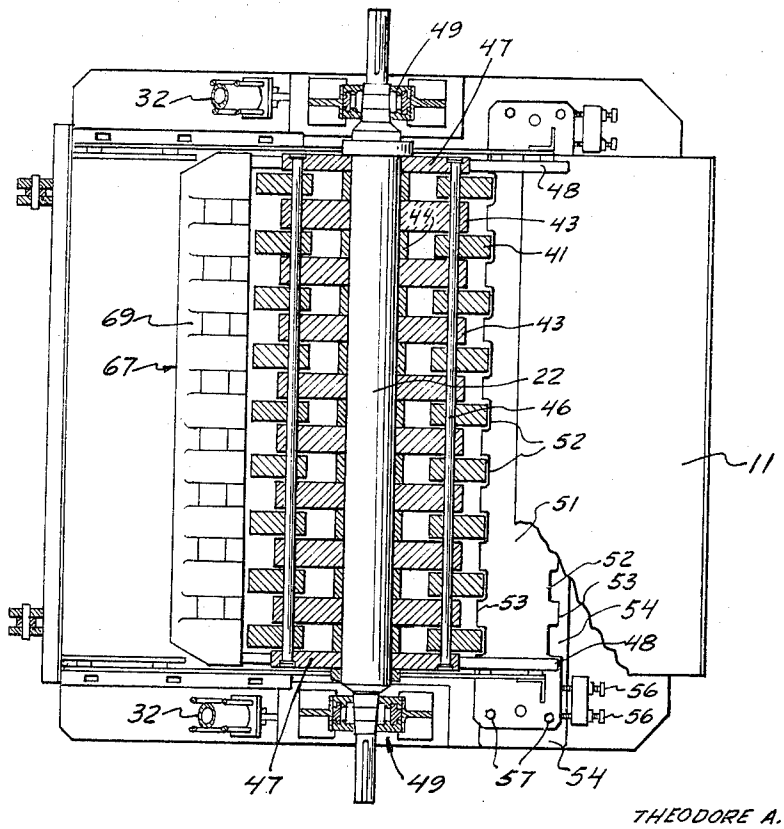


Fig. 4

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SHREDDING TYPE HAMMERMILL WITH AUTOMOBILE-FLATTENING FEEDER

Filed Aug. 26, 1966 3 Sheets-Sheet 1

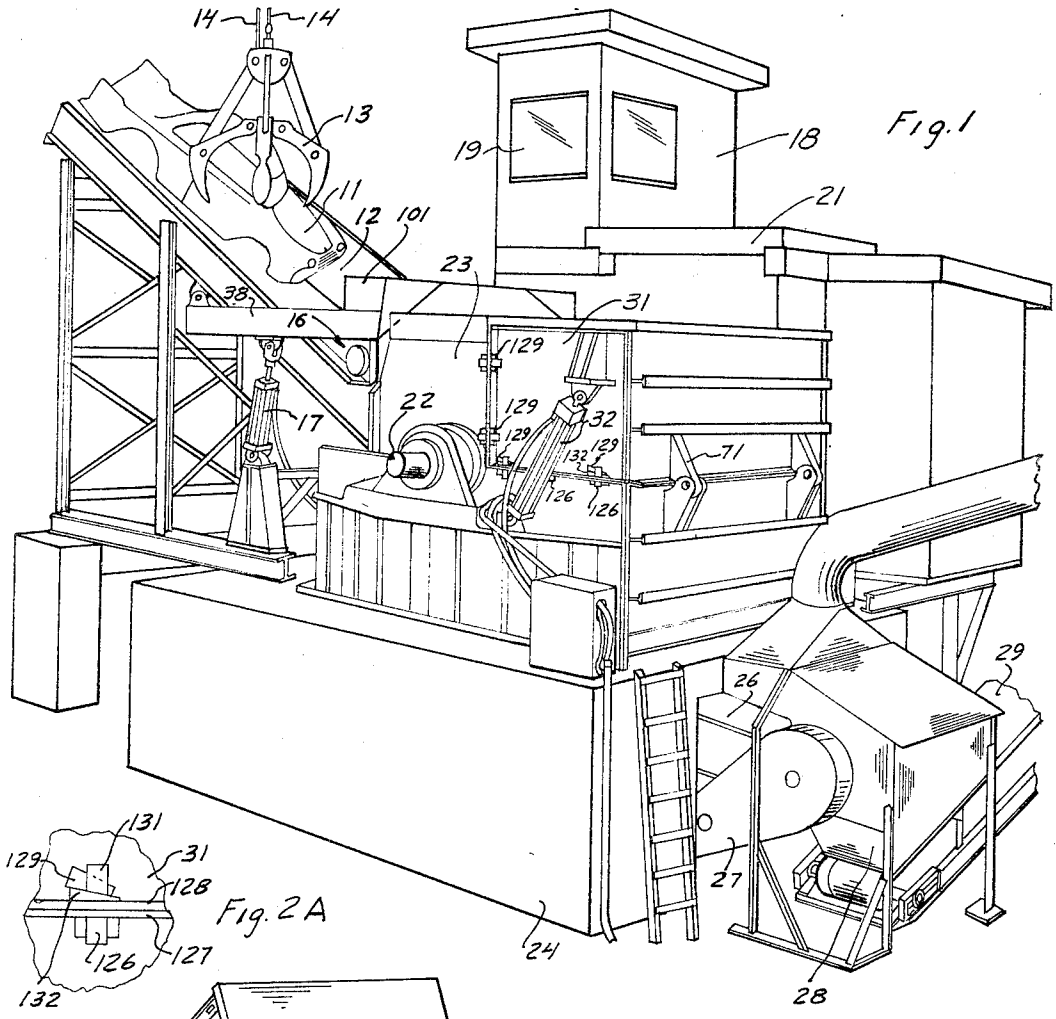


Fig. 1

Fig. 2A

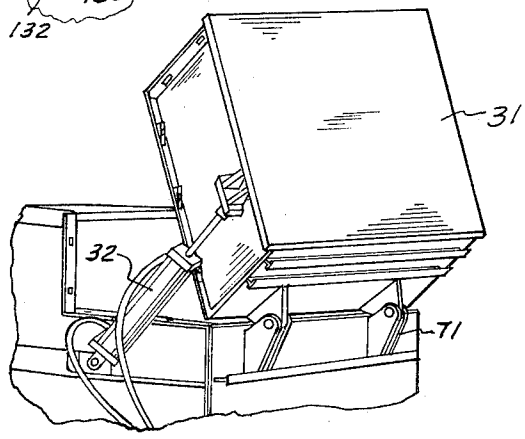


Fig. 2

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SHREDDING TYPE HAMMERMILL WITH AUTOMOBILE-FLATTENING FEEDER

Filed Aug. 26, 1966 3 Sheets-Sheet 3

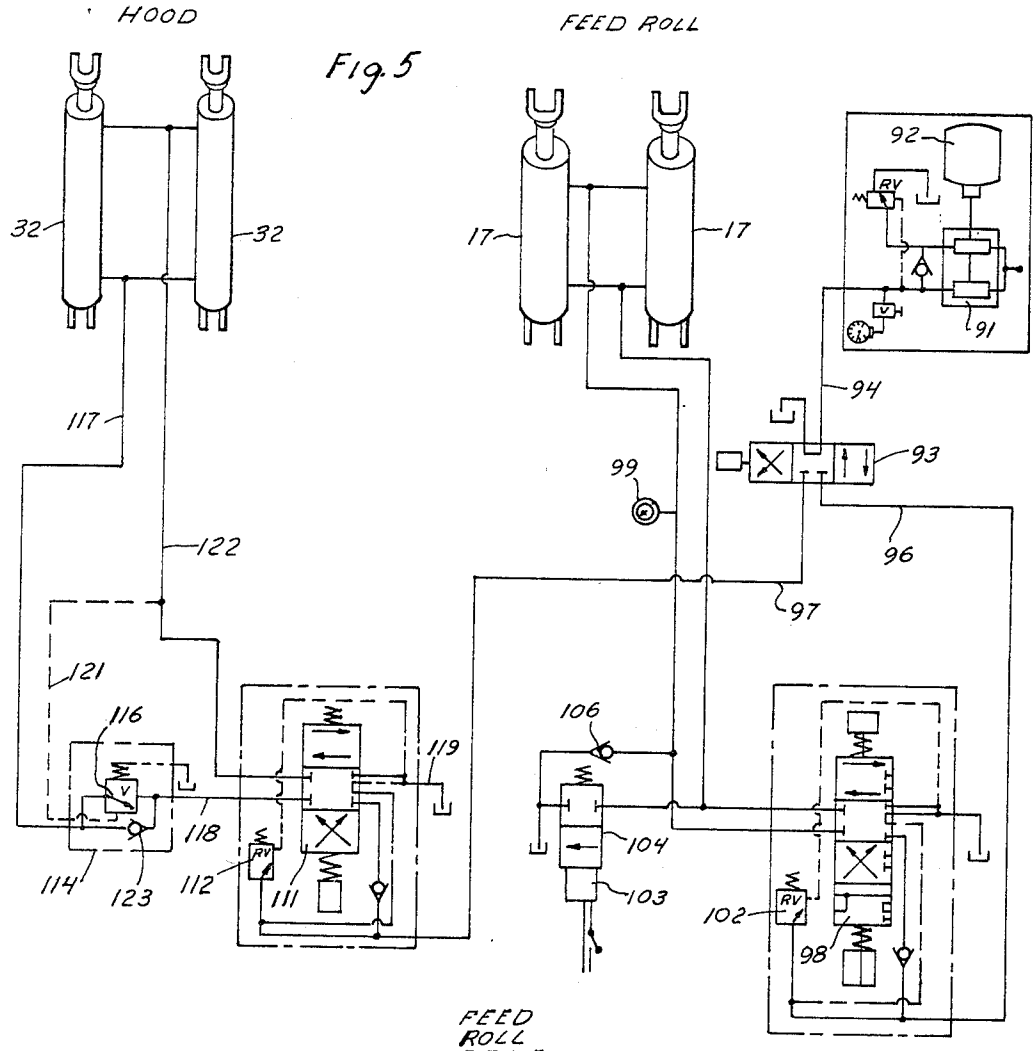


Fig. 5

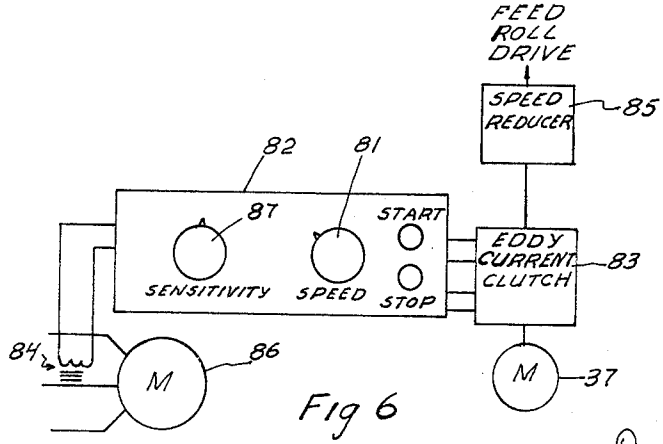


Fig 6

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United States Patent Office 3,489,078
Patented Jan. 13, 1970

3,489,078

SHREDDING TYPE HAMMERMILL WITH AUTOMOBILE-FLATTENING FEEDER

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Int. Cl. B30b 9/32; B02c 23/02, 13/04
U.S. Cl. 100—95 18 Claims

ABSTRACT OF THE DISCLOSURE

In a shredder for car bodies the bodies are fed over a notched cutter bar. A rotor has swing hammers of two lengths, one set passing through the notches and the other passing close to the teeth between the notches. Just beyond the cutter bar spaced bars and inward projections cooperate to let brittle material escape. Beyond these, escape of fragments is aided by sloping the sides of the bars which they will strike outwardly and in the direction of movement. The bodies are fed down a chute with feed controlled by a driven toothed roller which can move up and downwardly, being carried by a frame that is remotely pivoted. The rear-upper portion of the housing for the hammermill is a hood hinged at its rear edge and swinging past a balanced position. Hydraulic cylinder means are provided for the feeder and the hood each double-acting. A joint hydraulic system is provided with separate manual valves for the two functions and a selector valve for choice between the functions. The hood is closed by bolts held taut by wedges which rest on surfaces sloping in a direction such that vibration tends to tighten the wedges.

INTRODUCTION

The invention of which the present disclosure is offered for public dissemination in the event that adequate patent protection can be given relates to hammermill type shredders. The illustrated form of the invention is especially suitable for shredding junked automobiles, only slightly stripped.

Hammermills have long been used for shredding scrap steel but are better known in other uses such as crushing rock, grinding grain etc. Heavy hammers along the periphery of a rotor are rotated at high speed, their tips following a circular path known as the hammer circle. When a large piece of scrap metal is fed into the hammer circle, it is struck by hammers which tear off small pieces. The hammers may also sweep or throw a larger piece along within a cage of grate bars within which the hammer rotor rotates. Pieces which are small enough may escape through the grate openings, larger pieces being struck repeatedly until reduced to size.

According to the present invention, an automobile need not be preflattened. The tremendous power heretofore required is substantially reduced, even though a car body is quickly converted to small pieces. Reference to a car body herein connotes permissible inclusion of more than the bare body; usually frame and axles. Economy as to wear is achieved.

A number of features contribute to these results. A feeder, capable of flattening the bodies and restraining them, feeds them at a controlled and variable pace, reduced automatically if the hammermill is overloaded. The hammer rotor moves the hammers close to breaker or cutter bar and across the driection of feed. Preferably, the breaker bar is notched and alternate hammers pass through the notches to chop-tear slugs out of the metal fed into the hammer circle. Projecting tongues are then chop-torn off by intervening shorter hammers. Most of the grate

bars slope somewhat tangentially to the hammer circle for quick discharge of the fragments, and minimum wear.

The rear end of the hammermill, opposite the feed end, is a hood which may be opened for servicing. Safety features and quick-release clamps are provided.

Additional objects and advantages of the invention will be apparent from the drawings and from the following description.

DESIGNATION OF FIGURES

FIGURE 1 is a perspective view of an embodiment of the invention chosen for illustration, including adjacent related parts.

FIGURE 2 is a fragmentary view similar to a part of FIG. 1 but showing the hood of the hammermill raised for servicing.

FIGURE 2A is a view of a wedge clamp for the hood.

FIGURE 3 is a vertical sectional view through the hammermill, showing also the feeder.

FIGURE 4 is an approximately horizontal sectional view through the hammermill of FIG. 3, without the feeder.

FIGURE 5 is a hydraulic diagram for the hydraulic controls for the two pairs of hydraulic cylinders.

FIGURE 6 is a diagrammatic view of the feed roll drive.

DESCRIPTION OF BASIC PORTIONS

An embodiment of the invention is shown as a whole in FIG. 1. A car body **11** is placed on a feed chute **12** by a suitable lifting device such as a grapple **13**, operated by cables **14**, and controlled by a crane operator, the crane not being shown. A feeder head **16**, which includes a driven roller as will be described, may be raised and lowered by a pair of hydraulic cylinders **17** of which one is shown in FIG. 1. The raising and lowering and the drive of the feed roll may be controlled by an operator in booth **18**, who may view the feeding operation through a window **19**. A powerful motor in a motor shed **21** drives a shaft **22** on which the hammer rotor to be described is mounted. This hammer rotor is housed within the housing or body **23** of the hammermill which rests on a concrete foundation **24**. The foundation **24** has a passage through it in which a discharge conveyor **26** runs, being driven by a chain drive within the guard **27**. The conveyor **26** dumps into a hopper **28** which discharges onto a conveyor **29**, leading to the next unit of the plant.

The inside of the hammermill is made quite accessible by opening the upper rear portion or hood **31** of the hammermill housing, by means of a pair of hydraulic cylinders **32**, one of which is visible in FIGS. 1 and 2. The hood **31** is shown in the raised or open position in FIG. 2.

THE FEEDER

As seen in FIG. 3 a feed roll **36** above the lower end of chute **12**, is driven by a motor **37**, preferably at a controllable speed. Also, it is important to have means for raising and lowering the feed roll **36**, this means comprising hydraulic cylinders **17** which raise a feed roll frame **38** pivoted to the chute at **39**. As seen in the drawings, the feed roll is of large diameter and bears projections **40'**. It is thus a unit having a continuous series of projections following an endless path. These projections, in a long active part of the path move toward the chute and toward the rotor **40** to feed and restrain an automobile body, and to crush it in the sense of flattening it down. The pivotal axis at **39** for the swinging of frame **38** is, as seen in the drawings, so located that the entire feed roll or driven feed unit **36** moves nearly vertically so that its entire weight (and much of the frame weight) is almost fully effective toward crushing a body being

fed. Thus the axis is much more remote from the bite between roll **36** and the chute **12** than the diameter of the feed roll. Although the feed chute **12** is shown at a fairly steep pitch, this is primarily for the purpose of causing car bodies or the like to slide down to the feed roll **36**. Accordingly, the approach surfaces to feed roll **36** need not be so steep or need not be inclined at all, if other means is provided for moving the car bodies to a position at which they will be controlled by feed roll **36**, preferably providing some feeding force to aid the feed roll in advancing the car bodies into the hammermill. This may be a vibratory feeder. The feed roll, according to one feature of the invention, can be raised to a point of sufficient clearance (e.g. 40 inches) to receive under it the hood of an unflattened car body, is provided with a plurality of peg-like projections **40'** and can be powered down hydraulically. Feed unit **36** should be driven with enough power to draw the rest of a car body through under it, thereby crushing down the entire car body.

The feed roll **36** functions not only to move the car bodies into the hammermill, flattening them at the same time, but also to prevent them from being dragged into the mill too fast by the rotating hammers **41** and **42**.

ROTOR, BREAKER BAR AND GRATES

The hammers **41** and **42** are a part of a rotor **40** carried and driven by shaft **22**. More specifically, the hammers **41** are carried by arms **43**, and hammers **42** are carried by arms **44** which are interspersed between arms **43** and extend perpendicularly to them. Preferably the arms **43** and **44** are welded together, but in any event they are keyed to shaft **22** to be driven by it. The hammers **41** and **42** all swing on bolts **46**. They tend to maintain the position shown in FIG. 3 due to their centrifugal force, but will swing slightly from this position as they strike heavy objects and preferably can swing360 degrees about the axes of hammerbolts **46**.

The hammerbolts **46** are carried not only by the arms **43** or **44**, but also by end disks **47**, which are also keyed to shaft **22**. End disks **47** rotate within side liners **48** which preferably provide a small clearance for rotation of disks **47**. Shaft **22** is rotatably carried by sturdy bearing assemblies **49**. According to common practice, all internal surfaces of the hammermill housing which would be subject to wear and abrasion are protected by removable liners such as the liner **48**.

A breaker bar or cutter bar **51** is positioned at the discharge end of feed chute **11**. Preferably this bar extends fairly close to the hammer circle. It is also preferred that the breaker bar **51** be provided with notches **52** through which the hammers **41** swing. These notches separate projecting teeth or tongues **53** on the breaker bar which are located in the planes of rotation of the hammers **42**. It will be observed that the hammers **42** have an effective length shorter than that of hammers **41**. By this is meant that their outer tips are not as far from the axis of shaft **22** as are the outer tips of hammers **41**. It is desired that the longer hammers **41** chop slugs out of an entering car body, and that then the shorter hammers **42** chop off the intervening tongues. Cutter bar **51** rests on a table **54** on which it may slide. At present its position on table **54** is adjusted by screws **56** and the breaker bar is clamped in place by bolts **57**. Adjustability is not believed to be necessary however, because when wear is excessive bar **51** is turned. Breaker bar **51** is preferably reversible, having notches **52** and tongues **53** along the unused edge of the breaker bar, as seen at the lower right in FIG. 4. Since also either face can be up, it has four wear surfaces.

A series of fixed grate bars **61** and **67** with discharge openings therein extend around the rotor **40**. The first of these openings is as close to the breaker bar **51** as is practicable, separated only by a lower breaker bar **62**, which is immediately adjacent a support wall **63** for breaker table **54**. Each grate bar is supoprted only at its ends and hence its main body forms a sturdy beam. Each grate bar **61** has welded to it a series of spacer blocks **64** which projects inwardly to provide teeth **66** which help shred the car bodies in case any large pieces escape the chopping action of the hammers on breaker bar **51**, and to help release glass fragments and other abrasive dirt for immediate discharge through the relatively small grate openings in this area.

The seocnd type of grate bar **67** begins approximately one-eighth of a revolution beyond the breaker bar **51**. These bars **67** are cast of manganese steel with integral spacer lugs **68** and **68'**. According to the present invention, the surfaces of bars **67** facing against the hammer rotation slope outwardly and rearwardly so that metal pieces which strike them will be deflected outwardly to escape quickly from the hammer action. The quick escape of metal pieces after they have been reduced to size is desirable to reduce wear on the hammers and other parts. The rearward faces of beams **69** slope somewhat outwardly and rearwardly also, but this is incidential to other considerations such as providing adequate openings betyeen the grate bars. However, with the sloping grate bars of the present invention, the openings are preferably somewhat smaller than they might be with radially disposed grate bars, inasmuch as the sloping of the grate bars facilitates the passage of the metal pieces through the smaller openings. Hence, more or sturdier grate bars can be provided, with some reduction in the need for replacement due to wear.

When hood **31** of the housing is swung open on its hinges **71**, by hydraulic cylinders **32**, worn bars **67** and **61** and lower breaker bar **62** may be removed and replaced. Also access is given for easy replacement of hammers or building them up with welding. Cutter bar **51** may be removed endwise (parallel to the rotor axis) for turning or replacement.

At the end of the series of grate bars **67**, there is preferably provided an inwardly projecting deflector impact bar **72**. which preferably has ears welded to it for securing by bolts **70**. A substantial number of metal pieces which have not escaped the hammer area prior to reaching the impact bar **72** will be deflected by it and ejected into the discharge area **73**. A reinforcing beam **74** is positioned above the cover plate **76** in the vicinity most frequently struck by such pieces.

An additional removable breaker plate **77** is located in a position to be struck by pieces passing the breaker plate **72**. This breaker plate may be replaced by being raised nearly vertically, after withdrawing one securing rod **78**.

Feed roll **36** cannot only be raised and lowered as will be described, but also it is driven at a variable speed which is subject to both manual and automatic control. So long as the rotor of the hammermill rotates at nearly full speed, the manual control of the drive of feed roll **36** will prevail. This speed is controlled by a knob **81** on the operator's panel in control booth **18**. By experience, the operator will learn the most desirable speeds for different conditions of feed. Through a control system **82**, the speed of drive of roll **36** is controlled by variations in the energization of a magnetic clutch **83** of eddy current type through which motor **37** drives speed reduction gears **85**, by which roll **36** is driven. If the hammermill rotor encounters such heavy feeding that its speed is materially reduced, a current transformer **84** on one of the main current supply lines to hammermill **86** will detect an increased current flow and cause control system **82** to reduce the speed of drive of feed roll **36**, and if necesary, to stop this drive. The operator can control the sensitivity with which the speed is reduced by adjusting a knob **87**, which may be more remotely located. Another remote knob, not shown, can control the maximum speed attainable by knob **81**. The main portion of the control system **82** is a Louis Allis SCR Type MD–2 controller.

Control systems of this type are old, and have been used previously in controlling the feed to rock crushers. Accordingly, they need not be described in detail. Here, however, feed roll **36**, aided by gears **35** with a ratio of about 50 to 1, additionally restrains the bodies from being drawn in too fast.

HYDRAULIC SYSTEM

The preferred hydraulic system is shown in FIG. 5. A hydraulic pump **91** is driven by a motor **92**, with the usual gauge, relief valve, etc. A manual valve **93** selectively connects pump pressure (through line **94**) to either line **96** leading to the feed roll elevation control or to line **97** leading to the control for swinging open the rear housing portion or hood. In a third position valve **93** can connect pressure line **94** directly to return or discharge. The valve **93** is in the nature of a safety feature so that it will be impossible for the operator to inadvertently elevate the hood and the feed roll at the same time.

The line **96** leads to a second manual valve **98** which is the valve the operator ordinarily operates for controlling the elevation of the feed roll **36**. This valve has four positions. In the position shown the oil is ordinarily locked in the cylinders **17** holding them at whatever position they are in. The pump pressure is by-passed to return. This is the position to which the spool of the valve (which is connoted by the showing **98**) is spring-biased. When the spool is moved in one direction, outwardly of the valve (downwardly in FIG. 6) the pump pressure line **96** and the return line will be connected to the cylinders **17** in a direction to lower the roller **36**. Oil pressure varied with the amount of spool movement, can thus be added to the weight of the roller and the frame **38** to help crush a car body or to grip it more firmly for feed. A gauge **99** shows the amount of applied pressure.

When the spool of valve **98** is moved in the opposite direction, it approaches a first position in which the pump pressure line **96** and the return line are connected oppositely to cylinders **17** so that the feed roll is raised. With movement of the spool beyond this position the two ends of cylinders **17** are connected to each other so that the "float" condition is achieved and, subject to the weight of roller **36** and its frame **38**, the roller **36** may rise and fall as may be determined by the force exerted on it by a car body passing through. A weight **101** may be added to give the desired amount of pressure on a car body in this float condition.

A relief valve **102** may be set to determine the maximum pump pressure which will be delivered to cylinders **17**.

When the valve **98** is in its position of rest, the position at which the cylinders **17** are hydraulically locked, the feed roll **36** may nevertheless be lowered by energizing a solenoid **103** to operate valve **104** to connect the lower ends of cylinder **17** to discharge, a check valve **106** permitting the upper ends of cylinder **17** to draw oil so that there will be no cavitation.

When the selector valve **93** is moved in the direction to permit raising the hood, control of the hood is achieved in much the same manner by manual valve **111**. However, in this instance, the "float" position is not provided. A relief valve **112** may be set to a suitable maximum pressure at which the pump pressure will be delivered to the cylinders **32**. However, it should be observed that the hood swings far enough so that its center of gravity passes over the hood hinge axis. Hence the hood has to be power-moved at first, in closing, and then needs to be restrained so as not to slam shut. Accordingly, a counterbalance valve or pilot valve **114** is provided. When the spool of **111** is moved int he direction to apply pump pressure to the upper ends of cylinders **32** to lower the hood, and the hood passes the point at which it is balanced and begins to exert a pressure in the closing direction, the counterbalance valve **114** will close the line from the bottom of cylinders **32**, or partially close it to control the speed. Although the operation of such valves is well known, it may be explained that a spool represented by pointer **116** prevents downward flow from the line **117** through line **118** to discharge line **119** except when a predetermined pressure is applied to the spool through line **121**, known as the pilot line. A suitable pressure for opening the connection represented by arrow **116** is 200 pounds on the pilot line **121**. Thus, when valve spool **111** is moved toward the position for lowering the hood, pump pressure is applied to line **122** leading to the upper ends of cylinders **32**. However, the cylinders cannot lower the hood until line **117** is connected to discharge. This is accomplished as soon as the pressure in line **122** builds up to 200 pounds by virtue of the pilot line **121** which actuates the pilot or cushion valve **114** to make the connection represented by swinging arrow **116** into alignment with connecting line **118**. For raising the hood, check valve **123** permits the pump pressure to be delivered to line **117** regardless of the condition of the valve represented by the arrow **116**.

ADDITIONAL FEATURES AND FURTHER DISCLOSURE

Most operators desire the hood **31** to be securely fastened during operation. Heretofore, it has usually been secured by a series of threaded screws or nuts and bolts which had to be removed by the slow process of unscrewing. According to the present invention quick opening clamp means are provided. As seen in FIGURE 2A, a headed bolt **126** is slipped through passages in support flange **127** and flange **128**, which is part of hood **31**. A wedge **129** is slipped through a slot in stem **131** of bolt **126**, and driven tight so that it wedges flange **128** against flange **127**. If bolt **126** is vertically arranged as shown, there would be danger that vibration would loosen the wedge **129**. This loosening is avoided by providing a sloping seat **132** for wedge **129**, so that (under the influence of gravity and vibration) wedge **129** tends to move downwardly to the right, as seen in FIGURE 2A so as to maintain itself in wedging position. At locations where the bolt **126** is horizontally disposed the pin **129** will be inserted downwardly and the seat **132** is not needed. In either event, the end of the slot in stem **131** will be shaped to engage full face against the side of the wedge **129**. Where the seat **132** is provided it has an aperture through which stem **131** passes as it is inserted through flanges **127** and **128**.

Fabricated grate bars **61** and breaker bar or cutter bar **51** are preferably formed of a very hard steel alloy of an abrasion resistant class such as the U.S. Steel T–1 class, quenched and tempered. At present, a 321 minimum Brinnel hardness is specified. Because the more abrasive materials, such as glass fragments, are usually discharged through the first grate section (bars **61**) the following bars **67** need not be as hard, although they may work-harden.

The teeth **53** of cutter bar **51** present a severe problem in resisting bending and wear. In the present use they should not be less than 3″ in width, 2½″ having been known to bend laterally. Assuming that a thickness is chosen suitable for the job they should be substantially as wide as their thickness. For the teeth **53** to be 3″, or the preferred 4½″ wide, it follows that the hammers **41** must be spaced still further apart. It is partly because of this wide spacing of the hammers **41** that a second set of interspersed hammers **42** is desired. The teeth should not be too long, 3¼″ having been found to be satisfactory at least when reinforced along part of their length by resting on the table **54**.

Although there might seem to be danger of breakage of the teeth if they were made too hard, it has been found that the increased surface hardening resulting from torch cutting of bar **51** without subsequent tempering does not cause breakage, and reduces wear.

In one metal shredder according to the present inven-

tion the maximum speed of the feed roll **36** is set at about 55 peripheral feet per minute. A speed over 50 is rarely used, however, while the shredding is taking place. The rotor speed in that machine is 720 r.p.m. Theoretically, these comparative speeds would result in nipping the steel successively with such slight movement between nips that the desired action of chopping off slugs of moderate size would not be achieved. However, for some reason the theoretical action of merely nipping off toothpick like pieces does not occur. This is probably because the hammers, as they strike the metal are moving in a direction to seize the metal and draw it inwardly somewhat. Because of the tendency of the hammers to draw the metal in, it is important that the feed roller **36** be capable of restraining the metal, so as not to overload the hammermill.

A 2,000 horsepower motor is preferred for driving the rotor **40**, assuming the rotor to have a 74" outer hammer circle and to be 112" long, measured from the outside faces of the disks **47**. Much higher horsepower motors have been used heretofore for shredders of comparable output. As a matter of fact, an even smaller motor, 1500 horsepower has been used successfully with the present machine.

ACHIEVEMENT

In this field in which motors capable of delivering thousands of horsepower have been required, substantial savings of power use and motor size have been made. Wear has also been reduced. Of course, wear is inevitable on the cutter bar, the hammers and the grate bars, but the cutter bar may easily be turned to present successively four faces to wear, and replacement of the others is made easy by the hydraulic opening of the hood **31** and by quick opening clamps.

Car bodies with frames and axles and which have not been previously flattened can be drawn into the machine, and simultaneously progressively flattened or mashed down, by the driven and power-lowered feed and compressions roll. Because of its restraining action and partially automatic control of its speed, the bodies can be fed at a good speed without danger of overloading the hammermill.

In addition to making valuable scrap metal from junk which is mostly steel, such as car bodies, the present invention is useful in disposal of solid waste, such as the contents of city dumps, rubble from wreckage of buildings in which metal is often encountered, and the like. Of course, the feed roll clearance will usually not need to be as large for such uses, and some uses of some features of the invention may not need the feed roll at all or may use it differently located.

I claim:

1. Apparatus for shredding car bodies which may include frames and axles, including a feed and compression unit raisable to receive the hood portion of an unflattened car body thereunder, driven and lowered for progressively flattening the car body and for feeding it to be shredded at a controlled speed with restraining action thereon, and a hammermill for receiving the body fed by the feeder; said hammermill including:

a cutter bar over which the car bodies are fed, a cage including grate bars, extending initially downwardly and generally arcuately from said cutter bar, and a driven rotor having hammers thereon, rotating within the curvature of said cage with its axis so positioned that the hammers move close to the cutter bar and across the direction of entry of a body into the hammermill to chop-tear pieces from it;

said cutter bar having a series of notches therein opening toward the rotor and said rotor having one set of hammers disposed to pass through said notches, and another set of hammers terminating closer to the rotor axis and disposed axially between the hammers of the first set to cooperate with the portions of the cutter bar between the notches thereof;

the grate cage having a series of openings extending from near the bottom of the cage to a point in which the radial discharge direction is steeply upward, the surfaces forming said openings and which face against the direction of rotor rotation sloping outwardly and in the direction of rotation to permit relatively free passage of fragments in paths generally tangential to the hammer circle.

2. Apparatus for shredding scrap metal including restraining type metal feeding means and a metal chopping hammermill, said hammermill including a rotor carrying a plurality of longitudinally spaced hammers individually rotatable thereon and a stationary cutting member, said hammers having outermost portions extending outwardly of said rotor successively and alternately to each of two different lengths from the rotor axis so that said outermost portions of each successive pair of hammers sweep circles of different diameters in parallel planes, said cutting member comprising an elongate bar lying parallel to said rotating body and having a plurality of tongues and notches along one edge thereof and facing said rotor, said grooves being positioned to permit the passage therethrough of the longer of said hammers to form notches in the scrap metal, said tongues exending to close proximity of the path of the shorter of said hammers to cooperate with them in cutting away the material between said notches.

3. Apparatus for shredding scrap metal as set forth in claim **2**, including means removably mounting said cutting member to said hammermill and wherein said cutting member is generally rectangular in a cross section transverse of its length and includes a second similar row of tongue and groove means in the edge opposite said one edge and can be inverted and reversed to provide four successive sets of cutting edges facing the hammer action.

4. Apparatus for shredding scrap metal as set forth in claim **3**, including a supporting table below said cutting member and having an inward edge partially underlying the tongues for providing support therefor.

5. Apparatus for shredding scrap metal as set forth in claim **2**, including a supporting table below said cutting member and having an inward edge partially underlying the tongues for providing support therefor.

6. Apparatus for shredding metal as defined in claim **2** in which the tongues are at least as wide as substantially their thickness.

7. Shredding apparatus comprising a hammermill which includes:

a cutter bar over which the material to be shredded is fed, and a driven rotor having heavy swing hammers thereon, rotating with its axis so positioned that the hammers move close to the cutter bar and across the direction of entry of material into the hammermill to chop-tear pieces from it;

said cutter bar having a series of notches therein opening toward the rotor and said rotor having some hammers in one set of hammers disposed to pass through said notches, and the remainder of its hammers in another set of hammers terminating closer to the rotor axis and disposed axially between the hammers of the first set to cooperate with the portions of the cutter bar between the notches thereof; each set of hammers including a plurality of groups with the same axial distribution of the hammers therein whereby a plurality of hammers follow one another in each revolution of the rotor.

8. Shredding apparatus comprising a hammermill which includes:

a cutter bar over which the material to be shredded is fed, and a driven rotor having heavy swing hammers thereon, rotating with its axis so positioned that the hammers move close to the cutter bar and across

the direction of entry of material into the hammermill to chop-tear pieces from it;

said cutter bar having a series of notches therein opening toward the rotor and said rotor having some hammers in one set of hammers disposed to pass through said notches, and the remainder of its hammers in another set of hammers terminating closer to the rotor axis and disposed axially between the hammers of the first set to cooperate with the portions of the cutter bar between the notches thereof; each set of hammers including a plurality of groups with the same axial distribution of the hammers therein whereby a plurality of hammers follow one another in each revolution of the rotor;

including a feeder engaging the material close to the cutter bar for feeding material over the shredder bar at controlled speed and with restraining action thereon.

9. Apparatus for shredding metal including a feeder for feeding metal to be shredded at a controlled speed with restraining action on the metal and a hammermill for receiving the metal fed by the feeder; said hammermill including:

a cutter bar over which the metal is fed, a grate cage extending initially downwardly and generally arcuately from said cutter bar, and a driven rotor having hammers thereon, rotating within the curvature of said cage with its axis so positioned that the hammers move close to the cutter bar and across the direction of entry of metal into the hammermill to chop pieces from it;

the grate cage having a series of discharge openings with the surfaces which face against the direction of rotor rotation sloping outwardly and in the direction of rotation to deflect outwardly metal pieces striking said surfaces.

10. Apparatus for shredding metal including a feeder for feeding metal to be shredded at a controlled speed with restraining act ion on the metal and a hammermill for receiving the metal fed by the feeder; said hammermill including:

a grate cage extending initially downwardly and generally arcuately from the line of feed, and a driven rotor having hammers thereon, rotating within the curvature of said cage with its axis so positioned that the hammers move across the direction of entry of metal into the hammermill to chop pieces from it;

the grate cage having a series of discharge openings with the surfaces which face against the direction of rotor rotation sloping outwardly and in the direction of rotation to deflect outwardly metal pieces striking said surfaces.

11. Apparatus for shredding metal including a feeder for feeding metal to be shredded, and a hammermill for receiving the metal fed by the feeder; said hammermill including:

a cutter bar, a grate cage extending initially downwardly and generally arcuately from said cutter bar, and a driven rotor having hammers thereon, rotating within the curvature of said cage with its axis so positioned that the hammers move close to the cutter bar and across the direction of entry of metal into the hammermill to chop pieces from it;

said cutter bar having a series of notches therein opening toward the rotor and said rotor having one set of hammers disposed to pass through said notches, and another set of hammers terminating closer to the rotor axis and disposed axially between the hammers of the first set to cooperate with the portions of the cutter bar between the notches thereof;

said cutter bar being removable endwise and insertable in each of four positions to present different wear surfaces toward the hammer approach.

12. Apparatus for shredding metal as set forth in claim **11**, in which the grate cage is formed of separate bars slidable about the rotor axis to a point of removal, the hammermill including:

a hood hinged to give access to the point of removal, hydraulic means for raising the hood and wedge-type quick opening clamps for securing the hood in its closed position.

13. Apparatus for shredding car bodies including a feeder for feeding bodies to be shredded at a controlled speed with restraining action on the bodies, and a hammermill for receiving the bodies fed by the feeder; said feeder including:

a support sloping toward the hammermill;

a driven feed unit having a continuous series of projections moving through an endless path, in a substantial length of which the projections face the support while moving toward it and toward the hammermill to draw a body toward the hammermill while crushing it toward the support;

said feed unit being movable in a generally vertical direction whereby its weight exerts a substantial crushing force on the bodies and whereby a varying bite is formed with the support, said bite being near the hammermill, said feeder, when said unit is raised being able to receive under the unit the hood portion of an uncrushed car body;

hydraulic means for raising the unit and selectively operable in float condition to allow the weight of the unit to crush the body;

and means to drive the unit with sufficient power to draw the rest of the car body through under the unit thereby crushing the entire car body.

14. Shredding apparatus according to claim **13**, including a frame carrying the feeding unit and pivoted to swing about an axis substantially more remote from the bite than is any part of the path followed by the projections.

15. Shredding apparatus capable of shredding metal including a feeder for feeding large pieces to be shredded at a controlled speed with restraining action, and a hammermill for receiving the pieces fed by the feeder; said feeder including:

a support sloping toward the hammermill;

a driven feed unit having a continuous series of projections moving through an endless path, in a substantial length of which the projections face the support while moving toward it and toward the hammermill to draw a piece toward the hammermill while crushing it toward the support;

said feed unit being movable in a generally vertical direction whereby its weight exerts a substantial crushing force on the piece and whereby a varying bite is formed with the support, said bite being near the hammermill, hydraulic means for raising the unit and selectively operable in float condition to allow the weight of the unit to crush the piece.

16. Shredding apparatus according to claim **15**, including a frame carrying the feeding unit and pivoted to swing about an axis substantially more remote from the bite than is any part of the path followed by the projections.

17. Shredding apparatus capable of shredding metal including a feeder for feeding large pieces to be shredded at a controlled speed with restraining action, and a hammermill for receiving the pieces fed by the feeder; said feeder including:

a support sloping toward the hammermill;

a driven feed unit having a continuous series of projections moving through an endless path, in a substantial length of which the projections face the support while moving toward it and toward the hammermill to draw a piece toward the hammermill while crushing it toward the support;

said feed unit being movable in a generally vertical direction whereby its weight exerts a substantial crushing force on the piece and whereby a varying

bite is formed with the support, said bite being near the hammermill;

hydraulic means for raising the unit and for power-lowering the unit to crush the car body, and selectively operable in float condition to allow the weight of the unit to crush the metal.

18. Shredding apparatus according to claim **17**, including a frame carrying the feeding unit and pivoted to swing about an axis substantially more remote from the bite than is any part of the path followed by the projections.

References Cited

UNITED STATES PATENTS

2,655,213	10/1953	Anderson	83—355
2,869,793	1/1959	Montgomery	241—50

1,656,063	1/1928	Harrison	100—94
2,150,984	3/1939	Near et al.	241—186
3,202,369	8/1965	Judd	241—190
3,283,698	11/1966	Williams	100—97
3,326,478	6/1967	Van Endert	241—186
3,335,967	8/1967	Williams.	

FOREIGN PATENTS

1,115,310	12/1955	France.
685,576	1/1953	Great Britain.

BILLY J. WILHITE, Primary Examiner

U.S. Cl. X.R.

100—43, 170, 210; 241—186, 194