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METAL TRAP FOR HAMMER MILLS

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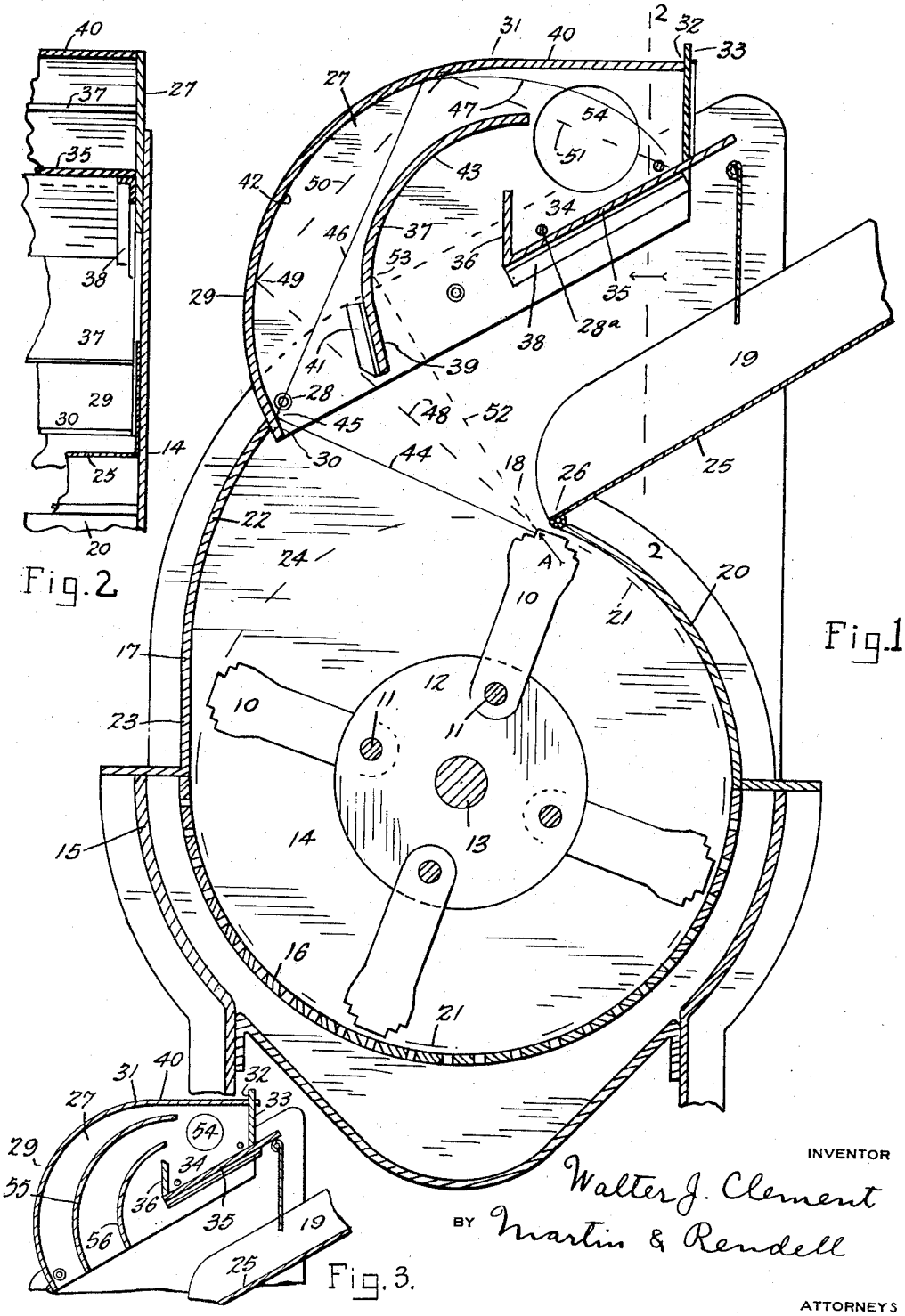

Fig. 2

Fig. 1

Fig. 3.

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METAL TRAP FOR HAMMER MILLS

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5 Claims. (Cl. 83—11)

This invention relates to metal traps for hammer mills.

The purpose of this invention is to provide a metal trap or metal extractor for use with hammer mills, which metal trap is of new and improved construction and is efficient and reliable in operation and durable in use and not apt to get out of order.

A further purpose is to provide an article of the class described which operates to remove a very large percentage of the foreign heavy material, such as bolts, nails, nuts and other metal pieces, before such metal parts go through the mill, that is, between the hammers and the screen, and particularly to have the trap so constructed and combined with the conventional hammer mill that the rotating hammers will strike such heavy foreign metal pieces and throw them into the trap without the said metal parts going around through the mill and past the screen even once.

Further purposes and objects of the invention will appear from the specification and claims herein.

Fig. 1 is a vertical sectional view through a hammer mill equipped with a metal trap embodying this invention.

Fig. 2 is a sectional view on line 2—2 of Fig. 1.

Fig. 3 is a vertical sectional view similar to Fig. 1 but on a reduced scale, of the upper part of a mill embodying the modification of the mill having three deflectors.

Referring to the drawing in a more particular description, it will be seen that the hammer mill is of the conventional type wherein a plurality of hammers 10 are revolubly mounted, and the hammers are preferably pivotally mounted upon their supporting member as by being pivoted to the rods 11 extending between the spaced disk or plates 12 which in turn are fixedly secured to the power-driven rotating shaft 13.

This series of revolubly mounted hammers is incased within the usual casing consisting of ends 14 and a lower half of the casing 15 in which is mounted the screen 16 of any desired construction according to the materials to be handled by the mill.

In the upper or covering portion 17 of the casing there is a feed inlet 18, into which leads the chute 19 in a slanting or non-radial direction, and with the body of the chute at an angle approaching a tangent to the portion of the circle of the travel of the ends of the hammers that is opposite the inlet. As the machine is illustrated in Fig. 1, the hammers 10 are rotating in an anticlockwise direction, and the portion 20 of the upper part of the casing before the inlet 18 is reached is circular in shape and only slightly spaced beyond the line of travel 21 of the outer end of the hammers. On the left hand part of the upper half of the casing as the parts are seen in Fig. 1, the cover portion 22 may have a part 23 at its lower end which is substantially vertical, but soon this cover part begins to curve to the right as it extends upwardly, but on a curve so as to gradually become farther spaced from the said line of travel 21 of the hammers, and thus provides a space 24 gradually increasing in height as it extends toward the right, until its upper portion comes to the lower end of the outer deflector 29 hereinafter described. As suggested by the arrangement of the parts in Fig. 1 the floor 25 of the chute being below the center line of the chute is ordinarily adjusted about at an angle approximately of forty-five degrees with the upper end of the casing portion 20 where the floor and said casing portion 20 come together as at the line 26. In other words, the floor 25 is about tangent to the line of travel 21 about half way between the end of the floor of the chute at line 26 and the lower end of the vertical part 23 of the cover. It follows, therefore, that as material is being fed through the chute partly by gravity due to the slanting floor of the chute and partly by the suction created by the rapidly rotated hammers, and in some mills, partly by the suction created by a pump or fan or other suitable means, the material slides off from the floor of the chute in a direction more or less converging to a tangential line relative to the line of travel of the hammers, just past or to the left of the line 26 being the end of the floor of the chute. In a mill that is to be provided with a metal trap embodying this invention the upper portion of the cover over the feeding inlet is not simply a continuation of the said portion 22 as shown in Fig. 1 but is provided with upwardly directed supplemental ends 27. These ends 27 may be formed integral with the upper half of the two main end walls of the mill or may, as indicated in Figs. 1 and 2, be separate parts fastened near their lower edge to the upper slanting edge of the regular end wall as by bolts 28, and through bolts 28a. Between the two extension ends 27 at their upper edge there is secured the upper and outer deflector 29. The lower end 30 of this deflector 29 is about radial to the axis of the shaft 13, but as the deflector extends upwardly it curves to the right, prefer-

ably by a continuous curve, until it is about over the axis of the shaft, say at point 31, and from here on the deflector preferably extends in a horizontal line and terminates at line 32 where it meets the upper end of a removable sliding door 33.

Mounted between the extended ends 27 there is an open top receptacle 34 the bottom 35 of which extends parallel to the lower edge of the extended ends 27 from their upper righthand edge approximately half way down the length of said ends, and reaching nearly to a vertical line drawn directly upward from the axis of the hammer. At the lower left end of the bottom 35 of the receptacle there is an upstanding wall 36 which forms the lower and left hand end of the receptacle 34 and prevents heavy articles, as foreign metal objects, from sliding down out of the receptacle 34 after they have been thrown thereinto by being struck by the rotating hammers and sent against the deflector 29 or the intermediate deflector 37. Conveniently, the bottom 35 of the receptacle may be supported by an angle iron 38 suitably secured to the lower inside surface of the extension ends 27. The vertically positioned sliding door 33 forms the upper right hand wall of the receptacle, and when this door is slid aside, access through the opening thus left is had to remove the heavy foreign articles that have been thrown into this receptacle together with a certain amount of the lighter material being ground that will come up with the said foreign metal parts. Each supplemental end wall 27 also has a removable clean-out plate 54.

In this machine I have shown one intermediate deflector 37 but it will be obvious that there may be more than one of these intermediate deflectors and in certain forms of my invention I may omit these intermediate deflectors entirely and depend upon the action only of the outer or upper deflector 27. For almost all purposes, however, I find it an advantageous construction and a much more efficient construction to have at least one intermediate deflector, as the deflector 37 shown in the drawing. This deflector is placed roughly about half way between the curved part of the outer deflector 29 and the middle part of the receptacle wall 36. As shown in the drawing the lower part 39, being from twenty to thirty per cent of the total length of said deflector, is straight and is in a line which if extended would pass through or near the axis of the hammer shaft 13. Above this lower straight portion 39 the intermediate deflector curves to the right as it extends upwardly. Preferably, its upper end extends about to or just beyond the top of the wall 36 of the receptacle, and the upper end of the intermediate deflector 37 is a little more than half way between the top of said wall 36 and the point or line 31 indicating the junction of the curved part of the outer deflector 29 with its upper right hand straight portion 40. Conveniently, a short length of angle iron 41 may be used to mount and support the lower part of the intermediate deflector 37, as by one web of said length of angle iron 41 being suitably fastened to the extension ends 27 while the other web of each of the two pieces of angle iron 41 will bear against the left hand face of the straight portion 39 of the deflector and may be fastened thereto in any desired manner.

It will now be seen that as heavy foreign matter such as pieces of metal are fed down through the chute with the other material to be ground, the said metal parts, before they have gone but a short distance beyond the line of travel 21 of the outer ends of the hammers, will be struck by the left hand or grinding faces of the very rapidly rotating hammers, and such heavy metal parts will be thereby thrown upwardly either against the concave inner surface 42 of the outer deflector, or against the inner and right hand surface 43 of the intermediate deflector 37. On account of the speed of the hammers 10 the grinding faces of said hammers will overtake the relatively slowly falling heavy material very soon after such heavy foreign matter leaves the floor of the chute, and accordingly the striking zone will be rather closely confined to the part indicated by the point of the arrow A. I have shown one hammer as having its forward face about in this striking zone. From the face of this hammer there is drawn a line 44 indicating one possible line of travel of foreign material on its way to strike the lower portion of the outer deflector 29 at point 45. From here it is assumed that the piece of metal will be deflected along line 46 to again strike the outer deflector at the upper part of its curved portion and from here the metal will be again thrown to the right, and probably now fall downwardly along the line 47 into the receptacle 34. The dash line 48 indicates the line of travel of another piece of metal struck perhaps a little farther back along the line of travel of the hammers, and so striking at point 49 farther up on the outer deflector, from which the metal will be deflected along line 50 to strike towards the flat portion 40 of the outer deflector and be thrown downward, say along line 51 into the receptacle. Dotted line 52 indicates the first course of the line of travel of another piece of metal. This course causes the piece of metal to be deflected at point 53 by the intermediate deflector 37 from which point the piece of metal may either rebound in a straight line, striking the upper part of the intermediate deflector, or the piece of metal may follow along more or less the curved inner line of said deflector, and in either event will be conducted into the receptacle 34. It will be understood that the three courses of travel are simply suggestive of possible courses that may be taken by the pieces of metal as they are struck. It will be understood of course that the courses of travel of the metal will be along greatly varying lines according to where the pieces of metal are struck and the precise angle at which they are struck, and after they have landed upon one deflector or another they may bound around between the deflectors or finally up the curved faces of the deflector. The force with which the said material is struck will in all cases be sufficient to make them rebound from or slide along the deflectors until they are deposited into the receptacle 34.

The lower surface of the bottom 35 of the receptacle forms the top of the feed chute 19.

It will be noted particularly that the action of this metal trap is to separate the foreign metal pieces from the regular material before the said foreign matter is carried through the mill, that is, past the screen so that the danger of such metal parts damaging the screen and other parts of the mill is very greatly lessened. By actual experiments I have found that a very high percentage, say eighty to ninety per cent, of foreign articles are separated from the material before going around past the screen.

The foreign parts that do not get thrown up

into the metal trap before going through the mill and past the screen, will ultimately land in the metal trap by reason of centrifugal force causing such foreign parts to fly off from in front of the hammer as the foreign parts come to the upper end of the part **20** and go at a tangent and against one of the deflectors into the receptacle.

This metal trap is non-clogging in that while some regular material may go up into the receptacle, it is being constantly drawn therefrom by gravity or sliding action, by the current of air passage around the intermediate deflector, or by the general suction of the machine, so that neither the receptacle nor the adjacent passages leading thereto ever become so packed with regular material as to prevent the foreign articles going through the passages of the deflectors and into the receptacle.

Fig. 3 shows a modification of my invention wherein three deflectors in all are provided. The outer deflector **29** and the other adjacent parts of the mill except the intermediate deflector **37** are the same as already described but in place of the single inside deflector **37**, two inside deflectors **55** and **56** are provided. The lower ends of the three deflectors are spaced about equal distances apart and the two inner deflectors extend upwardly and curve rearwardly and preferably divide the space between the outer deflector **29** and the lower front wall **36** into about equal compartments. Preferably also both the longer deflector **55** and the shorter inner one **56** extend just past the vertical line of the front wall **36** so that any foreign material carried along to the inner and rearward ends of these deflectors will fall into the receptacle.

What I claim as new and desire to secure by Letters Patent is:

1. The combination in a hammer mill of a series of revolubly mounted hammers, a casing thereabouts having a screen in its lower portion and an inlet in its upper portion, a feed chute slanting downwardly into said inlet and delivering the material to be milled in the same general direction as the travel of the hammers when passing the inlet, a receptacle for receiving heavy foreign material above the upper part of the chute and an enclosed passage beginning after the chute and above said inlet and leading upwardly and rearwardly to said receptacle, the side of said passage farthest from the chute being formed by a deflector having its lower portion approximately in line with the length of the passing hammers and, as it extends upwardly, being curved rearwardly relative to the line of travel of the incoming material the uppermost part of said deflector facing downwardly and forming the top wall of the passage and the top wall of the chamber of said receptacle and being spaced up from and directly over said receptacle, said deflector being the first surface engaged by heavy foreign material after the said incoming heavy foreign material is struck and diverted by the rotating hammers, said deflector operating to deflect said heavy foreign material upwardly and rearwardly through passages otherwise occupied only by partly milled material and directly into said receptacle said uppermost part of said deflector by facing downwardly and being directly over said receptacle allowing heavy material reaching only that part to drop into said receptacle by gravity.

2. The combination in a hammer mill of a series of revolubly mounted hammers, a casing thereabouts having a screen in its lower portion and an inlet in its upper portion, a feed chute slanting downwardly into said inlet and converging with the line of travel of the hammers when passing the inlet, a receptacle located above the upper part of the chute, for receiving heavy foreign material, and a plurality of enclosed passages beginning after the chute and above said inlet and severally leading upwardly and rearwardly to said receptacle, the side of each passage farthest from said chute being formed by a deflector having its lower portion approximately in line with the length of the passing hammers, and each deflector, as it extends upwardly, being curved rearwardly relative to the line of travel of the incoming material and terminating in a downwardly facing surface above and over said receptacle, any one of said deflectors being first surface engaged by heavy foreign material after the said incoming heavy foreign material is struck and diverted by the rotating hammers, said deflectors operating to deflect said heavy foreign material upwardly and rearwardly through passages otherwise occupied only by partly milled material and directly into said receptacle said downwardly facing surfaces of said deflector by terminating above and over said receptable allowing foreign heavy material that has reached that far and spent its force to fall therefrom by gravity into said receptacle.

3. The combination in a hammer mill of a series of revolubly mounted hammers, a casing thereabout having a screen in its lower portion and an inlet in its upper portion, a feed chute slanting downwardly into said inlet and converging with the line of travel of the hammers when passing the inlet, a receptacle located above the upper part of the chute and slanting downwardly substantially parallel therewith for receiving heavy foreign material, and a plurality of enclosed passages beginning after the chute and above said inlet and severally leading upwardly and rearwardly to said receptacle, the side of each passage farthest from said chute being formed by a deflector having its lower portion approximately in line with the length of the passing hammers, and each deflector, as it extends upwardly, being curved rearwardly relative to the line of travel of the incoming material and terminating in a downwardly facing surface above and over said receptacle, any one of said deflectors being the first surface engaged by heavy foreign material after the said incoming heavy foreign material is struck and diverted by the rotating hammers, said deflectors operating to deflect said heavy foreign material upwardly and rearwardly through passages otherwise occupied only by partly milled material and directly into said receptacle said downwardly facing surfaces of said deflector by terminating above and over said receptacle allowing foreign heavy material that has reached that far and spent its force to fall therefrom by gravity into said receptacle.

4. The combination in a hammer mill of a series of revolubly mounted hammers, a casing thereabouts having a screen in its lower portion and an inlet in its upper portion, a feed chute slanting downwardly into said inlet and converging with the line of travel of the hammers when passing the inlet, a receptacle for receiving heavy foreign material, located above the upper part of the chute and slanting downwardly substantially parallel therewith and having a wall at its lower end over the top of which there is

an outlet for good material to be carried out of the receptacle and down into the chamber of the mill and a plurality of enclosed passages beginning after the chute and above said inlet and severally leading upwardly and rearwardly to said receptable, the side of each passage farthest from said chute being formed by a deflector having its lower portion approximately in line with the length of the passage hammers, and each deflector, as it extends upwardly, being curved rearwardly relative to the line of travel of the incoming material and terminating over said receptacle, any one of said deflectors being the first surface engaged by heavy foreign material after the said incoming heavy foreign material is struck and diverted by the rotating hammers, said deflectors operating to deflect said heavy foreign material upwardly and rearwardly through passages otherwise occupied only by partly milled material and directly into said receptacle.

5. The combination in a hammer mill of a series of revolubly mounted hammers, a casing thereabouts having a screen in its lower portion and an inlet in its upper portion, a feed chute slanting downwardly into said inlet and converging with the line of travel of the hammers when passing the inlet, a receptacle located above the upper part of the chute, for receiving heavy foreign material, said receptacle having a slanting bottom approximately parallel with said chute and having a back wall at its upper end and a low front wall at its lower end and a plurality of enclosed passages beginning after the chute and above said inlet and severally leading upwardly and rearwardly to said receptacle and outwardly therefrom, the side of each passage farthest from said chute being formed by a deflector having its lower portion approximately in line with the length of the passing hammers, and each deflector, as it extends upwardly, being curved rearwardly relative to the line of travel of the incoming material and terminating over said receptacle, the outermost deflector contacting the back wall of the receptacle, any one of said deflectors being the first surface engaged by heavy foreign material after the said incoming heavy foreign material is struck and diverted by the rotating hammers, said deflectors operating to deflect said heavy foreign material upwardly and rearwardly through passages otherwise occupied only by partly milled material and directly into said receptacle at least one other deflector having its upper end spaced from the back wall and positioned above and in spaced relation to the low front wall thereby forming a plurality of passages leading to the receptacle, whereby each passage affords a path for heavy foreign material to pass to the said receptacle and the plurality of passages provide paths leading to, past and from the said receptacle for the currents of air created by the rotating hammers.

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