

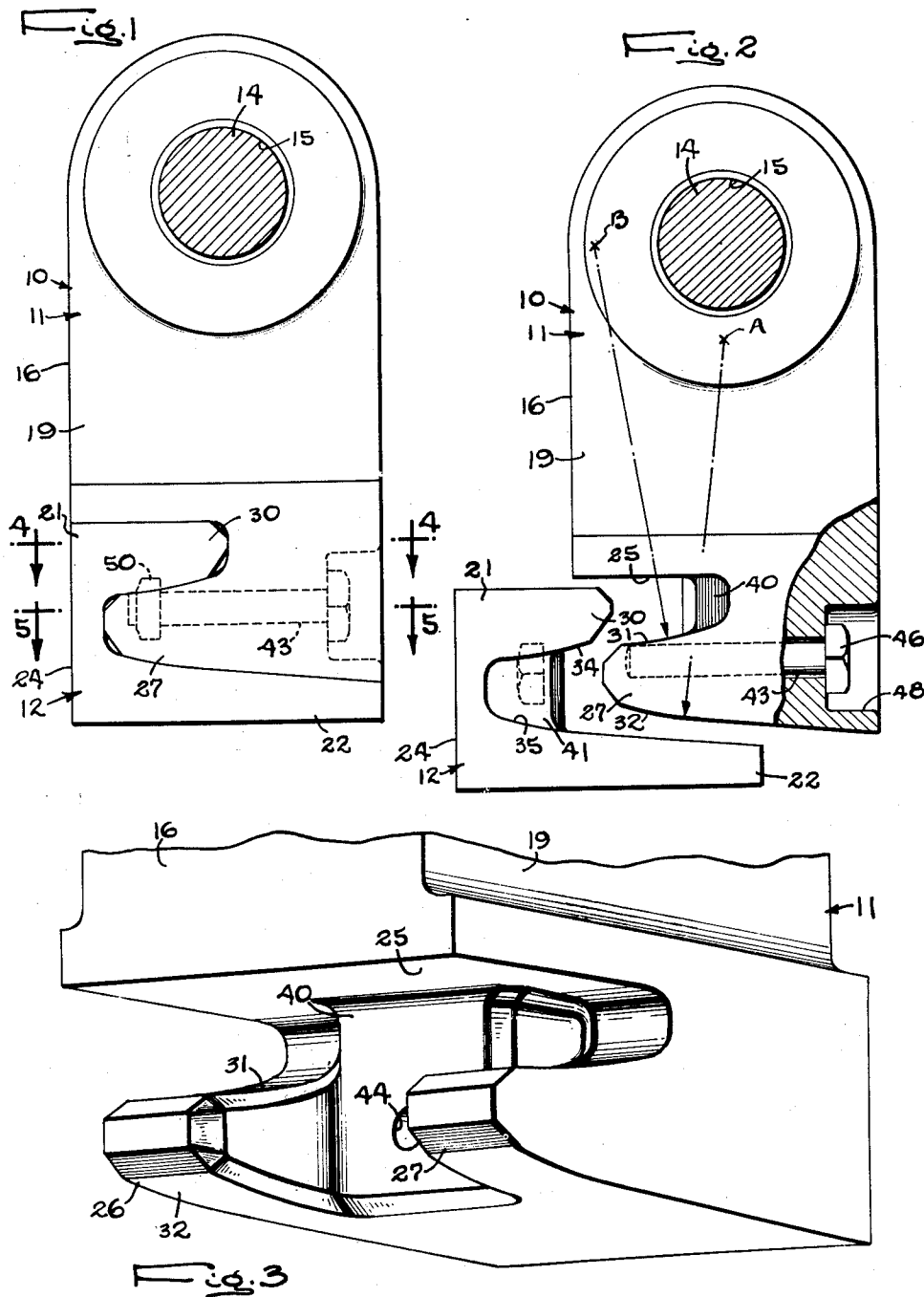
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HAMMER FOR IMPACT PULVERIZERS

2,534,302

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2 Sheets-Sheet 1



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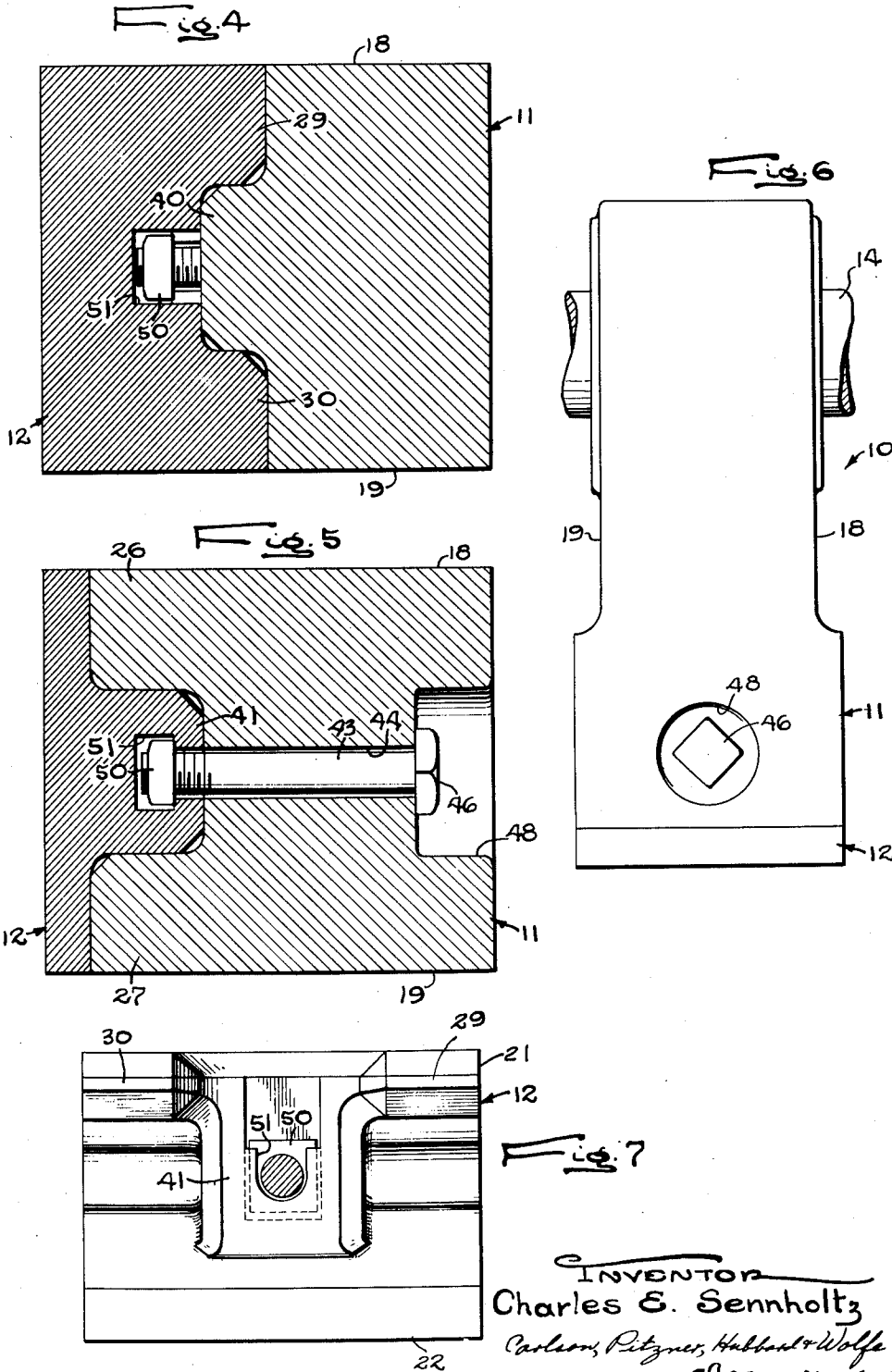
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HAMMER FOR IMPACT PULVERIZERS

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2 Sheets-Sheet 2



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HAMMER FOR IMPACT PULVERIZERS

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9 Claims. (Cl. 241-197)

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The present invention relates generally to rotary impact crushers or pulverizers, having particular reference to improvements in the revolving hammers for use therein.

An object of the present invention is to provide an improved hammer having a replaceable tip which is easily installed and removed and which is proof against accidental disengagement even under the most severe operating conditions. A more specific object of the present invention is to provide a pulverizing hammer and a replaceable tip therefor having novel engaging surfaces so that impact and centrifugal forces acting on the tip in the course of use tend to increase the holding engagement of the tip without increasing the difficulty of removing the latter.

Another object is to provide a hammer having a replaceable tip in which the tip is securely retained on the hammer in a novel manner so that the tip and the engaging surfaces are susceptible to large tolerances in size permitting economical manufacture of the tip with a minimum of machining operations.

A further object of the invention is to provide an improved pulverizing hammer which is inherently strong to withstand shock and impact forces and which has heavy duty working surfaces giving long useful life against abrasive forces.

A more detailed object of the invention is to provide a pulverizing hammer and a tip therefor having an improved fastener which is not subjected to impact stresses even under the most severe use and which is shielded from damage to permit easy removal of the tip after such use.

Other objects and advantages of the invention will become apparent as the description proceeds and in view of the accompanying drawings, in which:

Figure 1 is a side elevation of a hammer and replaceable tip constructed in accordance with the present invention.

Fig. 2 is a side elevation of the hammer and replaceable tip with the two parts separated to show the manner of installing the tip.

Fig. 3 is a perspective view of the engaging surfaces of the hammer.

Fig. 4 is a section taken along the line 4-4 of Fig. 1.

Fig. 5 is a section taken along the line 5-5 of Fig. 1.

Fig. 6 is a rear elevational view of a hammer and replaceable tip.

Fig. 7 is a rear view of the tip showing the fastening nut in place.

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While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions and uses falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, an impact hammer 10 embodying the present invention is adapted for use in various types and kinds of crushers, pulverizers or mills. The hammer construction may be readily understood without reference to the details of the pulverizer as a whole. It will suffice to say, therefore, that a plurality of such hammers are pivoted at the periphery of a rotating disk and are maintained in a radially extending direction due to the action of centrifugal force. The hammers are swung successively into contact with a mass of rock, coal or similar frangible material which is broken up into a loose mass by the impact.

As disclosed in Figs. 1 and 6, the hammer 10 comprises a hammer arm or shank 11 and hammer tip 12 secured to its lower portion. The hammer is pivoted pendulum-like at its upper end on a shaft 14 which is received in a bore 15. Rectangular in shape, the arm has a leading edge 16 and side walls 18, 19 extending rearwardly therefrom. The cooperating tip 12 is generally L-shaped having an upright leg 21 covering the leading edge of the lower portion of the shank 11 and a lower leg 22 underlying the end of the shank. The outer surface of the upright leg 21 forms a relatively massive impact face 24 and the horizontal leg 22 provides a protective shield or face for the end of the shank 11. It will be apparent that the tip 12 can also be provided with side walls extending rearwardly from the impact face 24 if added protection for the lower portion of the shank 11 and the engaging surfaces thereon is desired.

In accordance with one of the aspects of the invention, the arm 11 and replaceable tip 12 are joined by respective pairs of engaging surfaces which are curved in profile so constructed that the centrifugal and impact forces acting on the tip 12 tend to retain the tip in engagement even with relatively large variations in the dimensions of the tip 12. In the present instance the engaging surfaces are provided by interlocking, wedge-shaped tongues and recesses integral with the tip 12 and arm 11. The lower portion

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of the arm 11 is offset rearwardly from the leading edge 16 for about half the width of the arm forming a ledge or step 25. Carried by the offset portion of the arm 11 is a pair of parallel, laterally spaced tongues 26, 27 extending forwardly toward the leading edge 16 of the arm generally normal to the longitudinal axis of the latter. The cut-back or offset construction of the shank 11 affords clearance for the large surface area and heavy structure of the tongues 26, 27 and also provides a strong rectangular support for the tip 12 capable of resisting impact forces to which the hammer is subjected in use. The tip 12 is provided with a similar pair of tongues 29, 30 which extend rearwardly from the inner surface of the upright leg 21 perpendicular to the impact face 24.

To permit interlocking engagement of the tongues on the tip and the shank, receiving recesses or grooves in register with the respective tongues are provided. The upper face of the tongues 26, 27 and the ledge 25 of the body portion of the shank 11 define a recess or groove for the reception of the tongues 29, 30 on the tip. A corresponding recess for receiving the tongues 26, 27 on the shank is formed by the lower side of the tongues 29, 30 on the tip and the inner face of the horizontal leg 22.

It will be clear upon inspection of Figs. 1 and 2 that the tip may be positioned on the shank by inserting the tongues of the tip and shank in their respective recesses and sliding the tip rearwardly into locking engagement. With the tip 12 firmly seated on the shank 11, outward radial movement of the tip is prevented by interference between the surfaces of the tongues and recesses and only by sliding the tip forwardly toward the impact face 24 can the tip be removed from the shank.

In practicing the invention the tongues 26, 27 have upper and lower surfaces which are curved in the same direction and have their centers of curvature laterally displaced from each other. In the present embodiment, such curved surfaces, designated 31, 32, are arcuate in cross section with their centers horizontally offset from one another in the region of the bore 15 giving the tongues 26, 27 a wedge-shaped contour. As shown in Fig. 2, the center of the radius of the lower surface 32, indicated at A, lies on the longitudinal axis of the hammer arm 12 and slightly below the bore 15. Located in forwardly spaced relation thereto is the center of the radius of the upper surface 31, shown at B, adjacent the leading edge 16 of the shank and in horizontal alinement with the bore 15. Described with reference to the tongues 26, 27, the center of the lower surface 32 lies slightly to the rear of a longitudinal plane passing through the root of the tongues while the center of the upper surface is immediately forward of the leading edge of the tongues.

Locating the centers of curvature of the surfaces 31, 32 in this manner provides adequate draft for easy removal of the tip 12. The lower surface 32 progresses downwardly from the leading edge of the tongues to a point of tangency with the downwardly and rearwardly tapered end of the shank 11. The upper surface 31, due to the forward displacement of its center of curvature, curves upwardly from the leading edge of the tongues to the root of the latter. With the centers of curvature of the upper and lower surfaces 31, 32 positioned forwardly and rearwardly, respectively, of the extremities of the tongues, all por-

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tions of both surfaces slope in the direction of withdrawal of the tip 12. Consequently, there is no binding or interference to the easy insertion and removal of the tip.

To provide firm seating of the tip 12 on the shank 11, the engaging surfaces of the tip 12 conform in shape to the corresponding mating surfaces of the shank 11. Thus a curved surface 34 on the lower side of the tongues 29, 30 on the tip has the same curvature as the upper surface 31 of the tongues 26, 27 on the shank. Similarly, an arcuate surface 35 forming the inner face of the horizontal leg 22 of the tip corresponds with the surface contour of the lower edge 32 of the tongues 26, 27 and the tapered end of the shank.

It will be appreciated by one skilled in the art that the sharper the wedge shape of the tongues 26, 27, as with the centers of curvature approaching a common longitudinal plane of the arm or with longer radii of curvature, the greater will be the locking action between the engaging surfaces. Conversely, as the lateral spacing of the centers is increased or the radii shortened, there is a reduction of the locking action accompanied by an increasing impact resistance of the surfaces.

Curved engaging surfaces constructed as described above provide improved locking and impact resistance without danger of the tip "freezing" to the shank. With straight wedge-shaped surfaces, repeated blows tend to "freeze" the mating surfaces together making replacement difficult and time consuming. In the present construction the curved engaging surfaces absorb a large portion of the impact force on their steeply sloped sections and progressively dissipate less of the force on their more horizontal portions which provide the locking action. Thus the full impact is not taken by the locking portions of the surfaces, as is true with straight sided tapers, and rapid, easy disengagement of the tip is assured. As an added advantage, the curved surfaces permit relatively large dimensional variations in replacement tips, eliminating the need for costly machining or grinding of the hard materials used in the manufacture of the tips. In the case of straight-sided engaging surfaces dimensional inaccuracy causes skewing or cocking of the tip and consequently only point contact at the fore and rear edges of the engaging surfaces with reduced locking and impact resistance. The curved surfaces of the present construction nest one in the other even though the tip surfaces may be offsize giving a large area of engagement and producing good locking and impact resistance.

Sidewise movement of the tip 12 is prevented by ribs or bosses 40, 41 integrally attached to the shank 11 and tip 12 respectively. The rib 40 extends forwardly from the leading side of the offset portion of the shank 11 between the tongues 26, 27 and the recesses formed by the latter. The sides of the rib 40 provide partial closures for the inner openings for the recesses, serving as guides for the tongues 29, 30 on the tip 12. When the tip 12 is positioned on the shank, the end portions of the tongues 29, 30 lie on opposite sides of the rib 40 so that sidewise movement of the tongues 29, 30 in either direction is prevented by interference between the inner sides of the tongues and the sides of the rib 40 which are dimensioned to correspond to the spacing between the tongues 29, 30. The rib 41 on the tip is constructed in the same manner as the rib 40 on the shank and partially closes the inner ends of the recesses

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formed by the tongues 29, 30 on the tip. Rib 41 engages the inner surfaces of the tongues 26, 27 on the shank and in cooperation with the guiding action of rib 40 completely eliminates side-play and cocking of the tip 12.

In order to fasten the tip 12 on the arm 11 and to lock it positively in place thereon, a bolt 43 is provided which is received in a bore 44 drilled into the lower portion of the shank 11. At its trailing end the bolt 43 includes a head 46 which is recessed in a countersunk hole 48.

At the forward end of the bolt 43 means are provided for threaded engagement. Preferably this is accomplished by recessing a nut 50 in a T slot 51 formed in the rib 41 centrally of the impact face 24. Complete shielding for the nut 50 and T slot 51 is provided by the surrounding portions of the tip and the engaging tongues. The T slot 51 has the advantage that the nut may be inserted immediately prior to installing the hammer tip. Consequently, the threads are not affected by the heat treating processes to which the tip may be subjected during manufacture to increase its strength and resistance to abrasion. If desired, however, the bolt may engage directly the rib 41 by drilling and threading a hole therein. It will be apparent, too, that forming the bolt integrally with the tip and providing it with a fastening nut at its trailing end is included within the scope of the present invention. Because of the engagement of the curved engaging surfaces previously discussed, it has been found that the bolt is not subject to any stress other than that incident to its initial axial tightening.

This is a continuation-in-part of my application Serial No. 41,243 filed July 29, 1948.

I claim as my invention:

1. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm adapted to be supported at one end and having a forwardly extending wedge-shaped tongue on the opposite end thereof, said tongue having upper and lower surfaces which are arcuate in profile, the centers of curvature of said surfaces being located in the direction of the supported end of said arm and being forwardly and rearwardly spaced from each other, a replaceable tip having an impact face and an end face, said tip also having a rearwardly opening recess therein for receiving the tongue on said arm, the surfaces defining said recess being shaped to correspond with the mating surfaces of the tongues on said arm, the inner surface of said face portion having a T slot therein for the reception of a nut, said opposite end portion of the arm having a forwardly extending bore in axial alignment with said T slot and a bolt extending through the bore for tightening engagement with said nut.

2. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm having means at its upper end for supporting the same for bodily swing, a forwardly projecting tongue located at the opposite end of the hammer arm, and a replaceable tip having a rearwardly opening recess therein for receiving said tongue, said tongue being wedge shaped in profile and having arcuate upper and lower surfaces, the center of curvature of said upper surface being located in the direction of the supporting means and in forwardly spaced relation to the center of curvature of the lower surface.

3. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm hav-

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ing means at its upper end for supporting the same for bodily swing, a forwardly projecting tongue located at the opposite end of the hammer arm, and a replaceable tip having a groove therein for receiving said tongue, said tongue having upper and lower surfaces which are curved in the same direction, the centers of curvature of said upper surface being forwardly spaced from the corresponding centers of curvature of said lower surface so that said tongue is wedge shaped in profile.

4. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm having means at its upper end for supporting the same for bodily swing, a forwardly projecting tongue located at the opposite end of the hammer arm, and a replaceable tip having a groove therein for receiving said tongue, said tongue being wedge shaped in profile and having upper and lower surfaces which are arcuate and have centers located in the region of the supporting means.

5. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm adapted to be supported for bodily swing at one end, said arm having a shank portion and an opposite end portion offset rearwardly from the forward edge of the shank portion, a pair of parallel laterally spaced tongues on said offset end portion extending forwardly therefrom and defining a recess between said tongues and said shank portion, said tongues having single curved lower and upper surfaces, the center of curvature of said lower surface being located at a point on the shank of said arm rearwardly of the center of curvature of said upper surface so that said tongues are wedge-shaped, a removable tip having an upright leg forming an impact face and a horizontal leg, a pair of parallel laterally spaced tongues on said tip extending rearwardly of said impact face in register with the recesses on the arm and forming recesses with the inner surface of said horizontal leg for receiving the tongues on said arm, the surfaces of said recesses in said tip being curved to correspond with mating surfaces on the tongue of said arm for maintaining a snug fit between said mating surfaces, and a pair of bosses on said arm and said tip respectively, each of said bosses being located between the inner sides of the recesses defined by said tongues so that the bosses block sidewise movement of the tip.

6. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm having means at its upper end for supporting the same for bodily swing, a pair of laterally spaced tongues integral with the lower end, said tongues being forwardly extending wedges and having upper and lower surfaces which are curved in the same direction and have their centers of curvature forwardly and rearwardly spaced from one another, and a removable tip having a rearwardly opening recess therein for receiving said tongues and having a rib extending rearwardly into the recess between said tongues for preventing sidewise movement of the tip relative to the arm.

7. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm adapted to be supported at one end and having forwardly extending curved upper and lower engaging surfaces on the opposite end thereof, the centers of curvature of one of the surfaces being forwardly spaced from the corresponding centers of curvature of the other of the surfaces, a re-

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placeable tip having an upright leg forming an impact face and a lower leg underlying said opposite end of the arm, said tip also having rearwardly extending upper and lower surfaces in register with the surfaces on said arm for retaining the tip on said arm, said upright leg having a T slot in the rear side thereof for the reception of a nut, said opposite end portion of the arm having a bore therethrough in alinement with the T slot and a bolt extending forwardly through the bore for tightening engagement with said nut.

8. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm having means at one end for supporting the same for bodily swing and having upper and lower engaging surfaces on the opposite end portion thereof, and a replaceable tip having an impact face and rearwardly extending upper and lower engaging surfaces in register with the surfaces on said arm for preventing radial movement of the tip, said tip also having a T slot located rearwardly of said impact face for receiving a nut, said arm having a bore through the opposite end portion in axial alinement with said slot, and a bolt extending forwardly through said bore for tightening engagement with said nut.

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9. An impact hammer for rotary pulverizers comprising, in combination, a hammer arm having means at its upper end for supporting the same for bodily swing, a forwardly projecting tongue located at the opposite end of the hammer arm, and a replaceable tip having a groove therein for receiving said tongue, and a rib extending rearwardly into said groove, said tongue being recessed for receiving said rib to provide lateral interference therebetween, said tongue being wedge shaped in profile and having upper and lower surfaces which are curved in the same direction and have centers of curvature located upwardly along said arm.

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