United States Patent

[11] **3,549,095**

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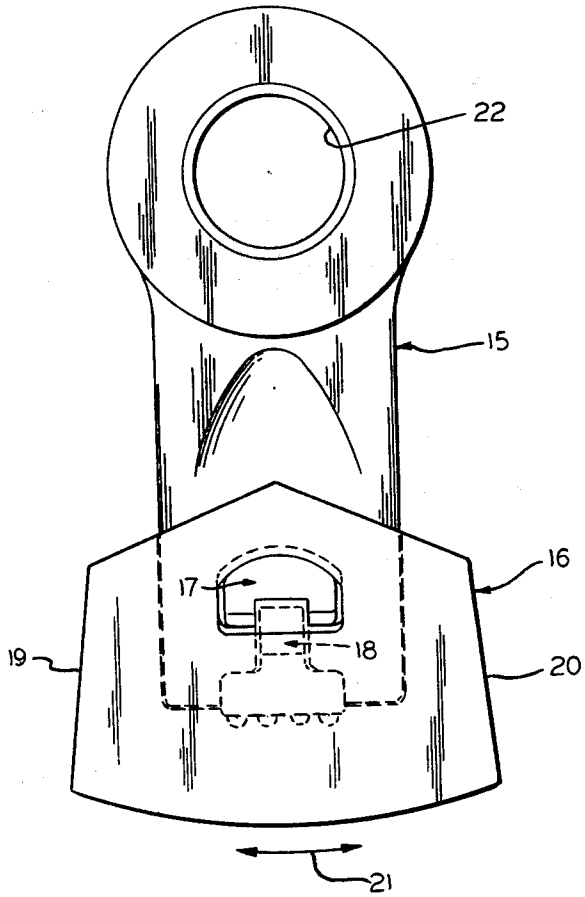
[54] **PULVERIZER HAMMER FOR A HAMMER MILL**
17 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **241/197**
[51] **Int. Cl.** **B02c 13/28**
[50] **Field of Search** 241/195, 197

[56] **References Cited**
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ABSTRACT: Pulverizer hammer for a hammer mill having an arm, a renewable tip for the arm that can be easily removed and replaced, and means for locking the tip onto the arm including a pin and an elastomeric lock.

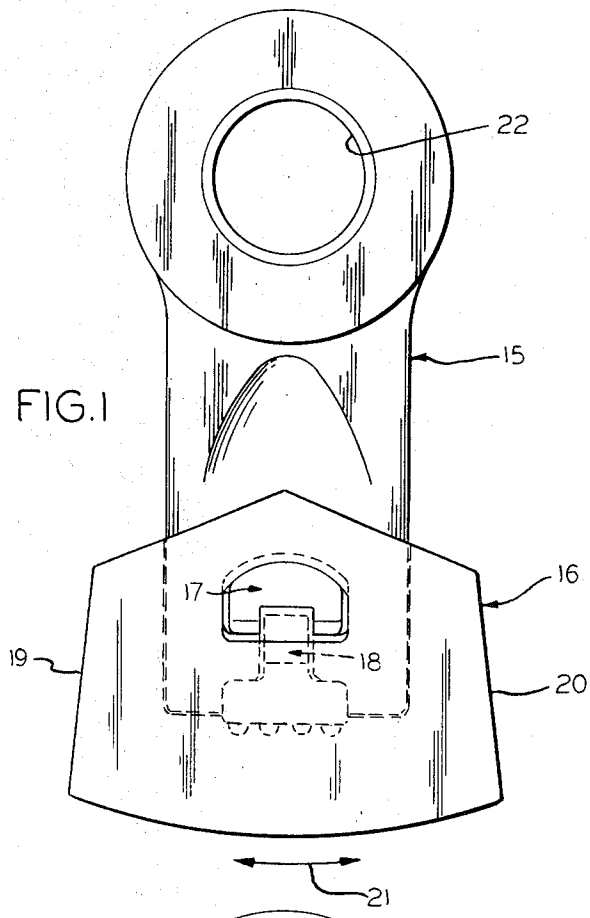


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SHEET 1 OF 3

FIG. 1



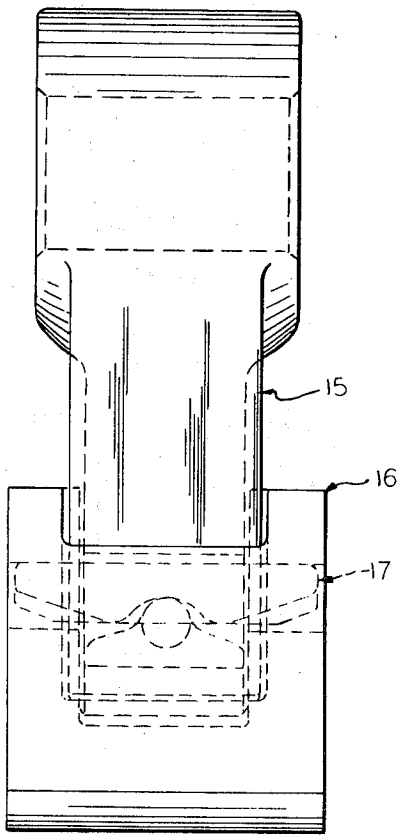
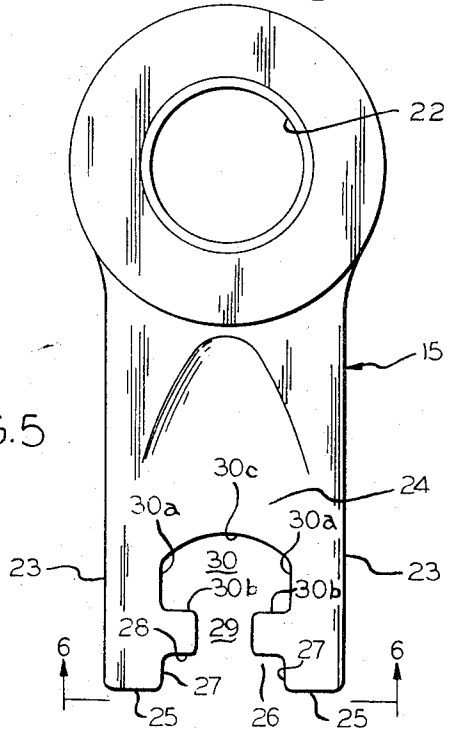


FIG. 2

FIG. 5



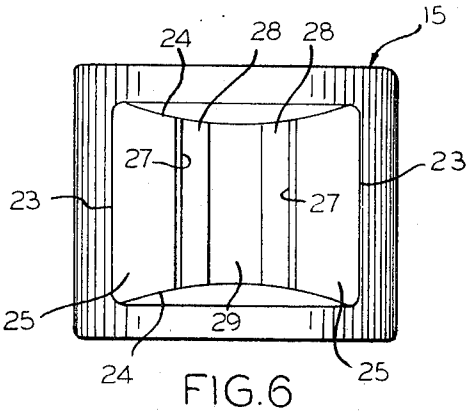
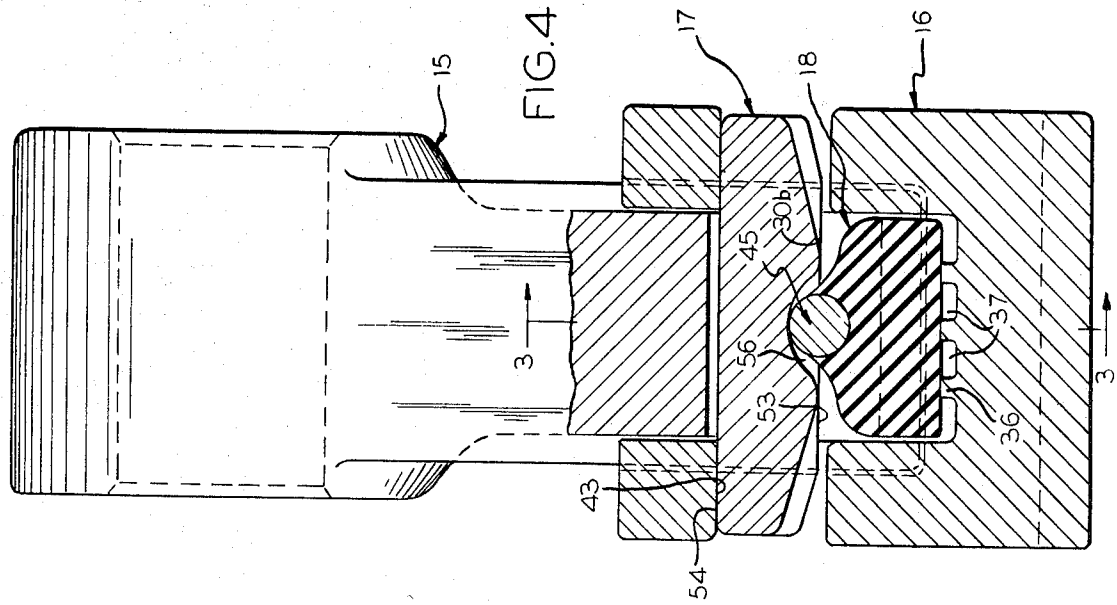


FIG. 6

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FIG. 4



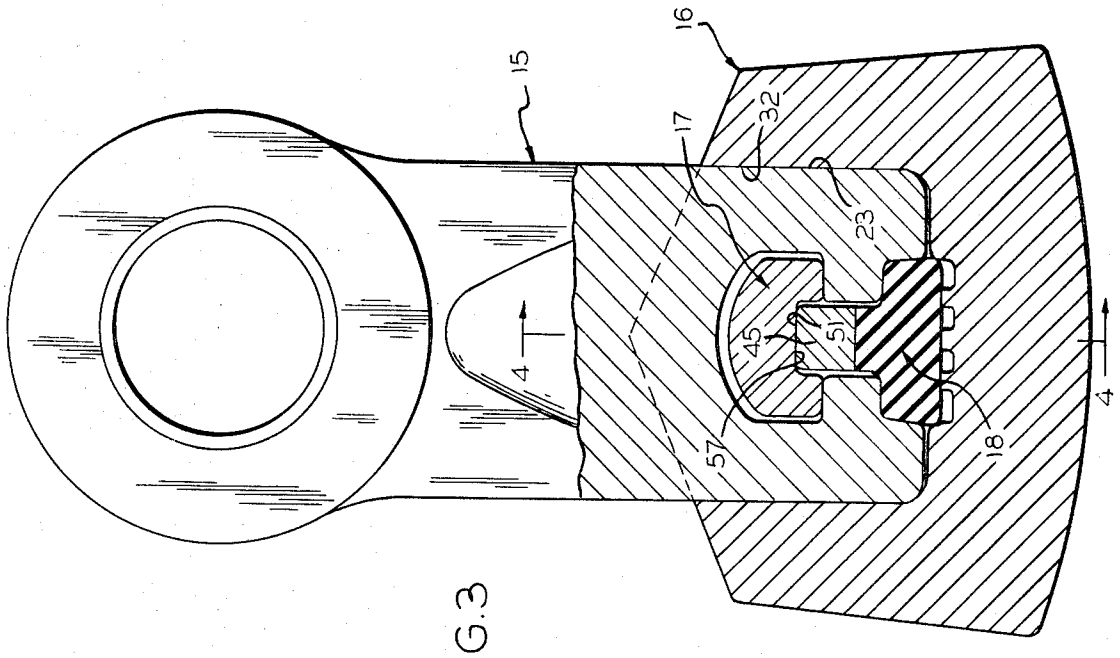


FIG. 3

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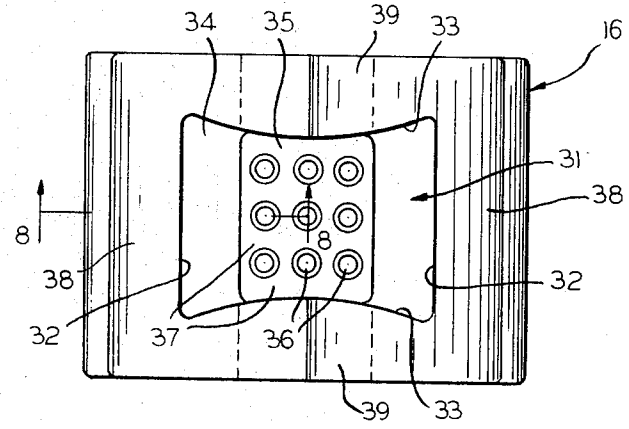


FIG. 7

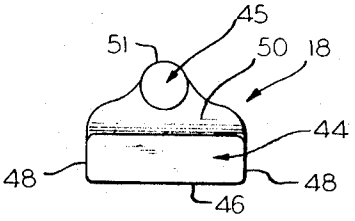


FIG. 12

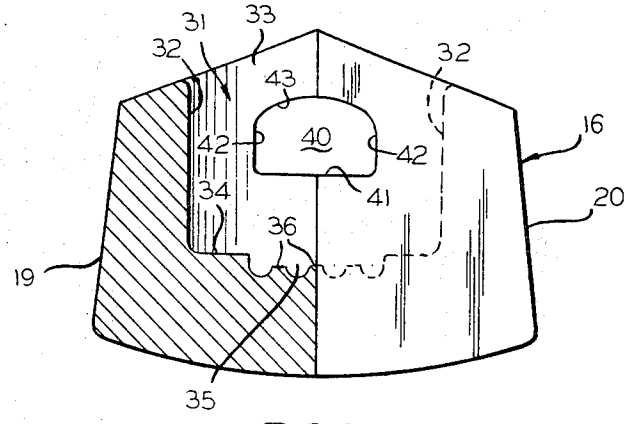


FIG. 8

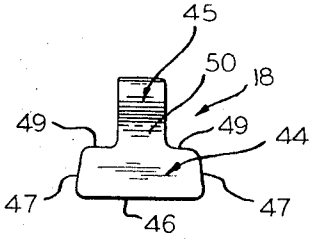


FIG. 13

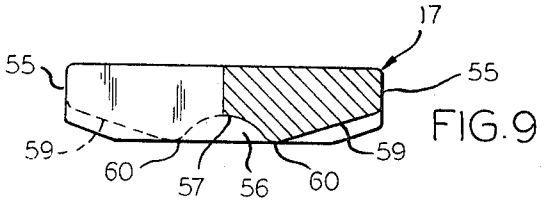


FIG. 9

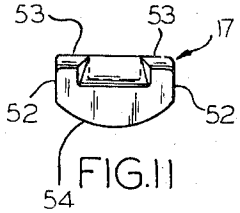


FIG. 11

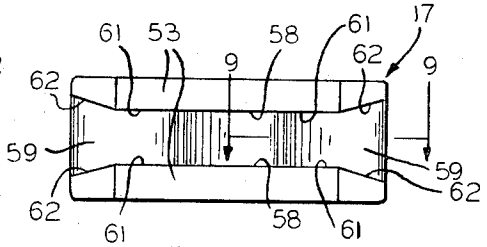


FIG. 10

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PULVERIZER HAMMER FOR A HAMMER MILL

This invention relates in general to a hammer for a hammer mill, and more particularly to a hammer having a low cost, renewable tip that may be easily removed and replaced, and still more particularly to a two-part hammer having a removable and replaceable tip with greater bearing area between the tip and arm of the hammer that increases the life of the hammer and especially the hammer arm.

The hammer of the present invention is of the type used in hammer mills for crushing, comminuting, or pulverizing rocks or other materials. In a two-part hammer like that of the present invention, it is important that the best possible bearing contact be established between the arm and tip, and to also enhance the removability and replaceability of the tip, in minimum time to minimize the downtime of the mill.

The pulverizer hammer of the present invention includes an arm or shank that is adapted to be mounted on a rotating shaft of the mill, a tip having a socket for receiving the free end of the arm, and means for locking the tip onto the arm and for providing the best possible bearing contact between the tip and arm. The locking means includes a pin that is receivable in a pinway defined by aligned hole means in the tip and arm, and an elastomeric lock that is held by the top and arm and coacts with the pin to retain it in locking position. The engaging surfaces of the arm and tip are formed to provide maximum bearing contact in assembled relation. Similarly, the engaging surfaces of the tip and arm hole means with the pin are formed to provide maximum bearing contact. This results in increasing the life of the arm, together with providing a good fit between the arm and tip throughout the life of the tip. The elastomeric lock includes an elastomeric body having a metal or the like insert that coacts with a cavity in the pin to lock the pin in assembled position. Recesses are formed in the arm and tip for holding the lock in position.

Accordingly, it is an object of the present invention to provide an improved hammer for a hammer mill having a removable tip that may be easily removed and replaced.

Another object of this invention is in the provision of a two-part pulverizer hammer for a hammer mill including an arm, a tip fitable on the arm, and means for locking the tip on the arm and which facilitates removability and replaceability of the tip.

Still another object of the present invention resides in the provision of a hammer for a hammer mill including an arm, a tip fitable on the arm, and means for removably locking the tip onto the arm, wherein the mating surfaces of the arm and tip are formed to provide a maximum impact bearing surface that enhances the life of the arm.

A further object of this invention is in the provision of a hammer for a hammer mill including an arm, a renewable tip fitted on the arm, and locking means for locking the tip onto the arm, wherein the locking means includes a pin insertable in a pinway formed in the tip and arm and an elastomeric lock for retaining the pin in assembled position, while at the same time enabling it to be easily removed for replacement of the tip.

Still another object of the present invention resides in the provision of a hammer for a hammer mill including an arm, a tip fitable on the arm, and means for removably locking the tip onto the arm, wherein the mating surfaces of the arm and tip are formed to provide a maximum impact bearing surface that enhances the life of the arm.

A further object of this invention is in the provision of a hammer for a hammer mill including an arm, a renewable tip fitted on the arm, and locking means for locking the tip onto the arm, wherein the locking means includes a pin insertable in a pinway defined by aligned hole means in the tip and arm, and an elastometric lock for retaining the pin in assembled position, and where the mating surfaces of the pin and tip hole means are formed to provide a greater bearing contact, and further where the tip and arm are formed so that the hole means of the tip, while providing greater bearing surfaces for contact with the pin, also reduces the load on the pin by shifting the area of shear closer to the center of the pin.

Other objects, features and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

FIG. 1 is a side elevational view of the hammer according to the present invention, illustrating some parts in dotted lines for purposes of clarity;

FIG. 2 is an end elevational view of the hammer according to the present invention, and illustrating some parts in dotted lines for purposes of clarity;

FIG. 3 is an enlarged, side elevational view of the hammer according to the present invention and showing the end of the arm, and the tip in section as taken substantially along line 3–3 of FIG. 4;

FIG. 4 is an enlarged and elevational view of the hammer and showing the end of the hammer and the tip, and associated parts in section as taken substantially along line 4–4 of FIG. 3;

FIG. 5 is a side elevational view of the arm of the hammer according to the present invention;

FIG. 6 is a plan view of the very end of the arm, taken substantially along line 6–6 of FIG. 5;

FIG. 7 is a top plan view of the tip of the hammer according to the present invention;

FIG. 8 is a partial, side elevational view of the tip and a partial section of the tip, as taken generally along line 8–8 of FIG. 7;

FIG. 9 is a partial, side elevational view of the pin employed in the locking means for locking the tip onto the arm, according to the present invention, and a partial, sectional view taken substantially along line 9–9 of FIG. 10;

FIG. 10 is a bottom plan view of the pin;

FIG. 11 is an end elevational view of the pin;

FIG. 12 is a side elevational view of the elastomeric lock employed in the means for locking the tip onto the arm according to the present invention; and

FIG. 13 is an end elevational view of the lock.

Referring now to the drawings and particularly to FIGS. 1 to 4, the hammer of the present invention includes generally an arm 15, a tip 16 removable and replaceable on the free end of the arm or shank 15, and a locking means for locking the tip onto the arm comprising a pin 17 and an elastomeric lock 18. The tip of a hammer is subjected to constant wear during the course of operation, thereby ultimately demanding replacement of the hammer for the tip and arm where integral, or demanding as in the present invention the replacement of the tip 16. In particular, the tip 16 is symmetrically formed for operation on the arm 15, and includes pulverizing faces 19 and 20, which are on opposite ends of the tip and extend substantially normal to the path of hammer movement. The hammer movement is illustrated in FIG. 1 by the double arrow 21, and is readily appreciated, since the arm 15 is provided at its upper end with a bore 22 permitting the mounting of the arm on a rotatable shaft of the hammer mill. The shaft is not shown for purposes of simplicity. Thus, the pulverizing faces 19 and 20 perform the pulverizing, crushing or comminuting action of the hammer, when the hammer is operative in a mill, depending upon the direction of rotation.

The free end of the arm 15 is generally rectangular in shape and includes, as seen in FIG. 6, substantially parallel, opposed, end wall surfaces 23, and opposed, symmetrically formed, concave sidewall surfaces 24. The terminal end of the arm is defined by a relatively flat wall surface 25 that has formed therein a recess 26 for receiving one end of the elastomeric lock 18. The recess is arranged medially of the wall surface 25 and extends between the sidewall surfaces 24 and in substantial parallel relation to the end wall surfaces 23. The recess 26 is defined by upwardly and slightly inwardly inclined, sidewalls 27 and a bottom wall 28. A slot 29 is formed in the bottom 28 of the recess 26 to permit a part of the elastomeric lock 18 to extend into the hole means 30 that receives the pin 17. The slot 29 extends between the sidewall surfaces 24 as does the hole means 30. The hole means 30 is defined by opposed, sub-

stantially parallel extending, sidewall surfaces **30***a*, a bottom wall surface **30***b* and an upper wall surface **30***c*. The upper wall surface is concave, while the bottom wall surface **30***b* is flat and substantially normal to the sidewall surfaces **30***a*. Moreover, the bottom wall surface **30***b* is effectively split by the slot **29** that opens therethrough and centrally thereof.

The tip **16** is shaped to complementally fit onto the free end of the arm **15**, and includes a socket **31**, FIGS. **7** and **8**, formed in the upper end. The socket is defined by substantially parallel, opposed, flat end wall surfaces **32**, and opposed symmetrically formed, convex, sidewall surfaces **33**, and a bottom wall surface **34**. The shape of the socket **31** is generally rectangular, like that of the arm **15**. A shallow recess **35** is formed centrally in the bottom wall **34** for receiving the lower end of the elastomeric lock **18**. A plurality of upstanding support members or lugs **36** are provided on the bottom of the recess **35** to support the elastomeric lock slightly above the bottom of the recess, and to define open areas **37** into which the elastomeric lock may flow when the hammer is completely assembled. The upper ends of the lugs **36** are below the bottom wall **34** of the socket.

The socket **31** being formed in the upper end of the tip **16** defines at the upper end opposed end walls **38**, and opposed sidewalls **39**. Hole means **40** extends through the sidewalls **39** along an axis normal to the sidewalls. The hole means **40** is arranged medially between the end walls **38**. Further, the hole means **40** includes a hole extending through each of the sidewalls and is defined by a bottom surface **41**, side surfaces **42** and an upper surface **43**. The side and bottom surfaces are flat, while the upper surface is concave or arcuate. Further, the side surfaces extend substantially parallel to each other and substantially normal to the bottom surface. When the tip is mounted on the end of an arm, the hole means **40** aligns with the hole means **30** of the arm to define a pinway for receiving the pin **17**.

The locking means for locking the tip onto the arm in includes the pin **17** and the elastomeric lock **18**. These elements function together, wherein the lock **18** retains the pin in the pinway defined by the arm and tip hole means, when the parts are assembled. The lock **18** is held in place by the recess **26** of the arm **15** and a recess **35** of the tip **16**.

The elastomeric lock **18** includes an elastomeric body **44** and a metal insert **45**. The elastomeric body **44** may be made of any suitable rubber, and the insert **45** is vulcanized into position and to the body, so that the insert functions integrally with the body. Any type of suitably resilient material may be provided for the elastomeric body, and any suitable type of rigid insert may be secured thereto.

The elastomeric lock **18** includes a base wall **46**, upstanding side and end walls **47** and **48** respectively, and upper ledge walls **49**. Extending upwardly from the lower part of the body and along the longitudinal axis and between the end walls **48** is a narrow web **50**, that has the metal insert **45** vulcanized thereto, at a medial position. The ledge walls **49** extend inwardly as seen in FIG. **13** to the web **50**. As shown, the metal insert **45** is defined by a cylindrical member having a cylindrical face **51** that is adapted to be engaged by the pin **17**. The axis of the cylindrical metal insert **45** extends substantially normal to the longitudinal axis of the body as taken along the sidewalls **47**. As seen most clearly in FIG. **3**, the web **50** and metal insert **45** extend upwardly through the slot **29**, while the metal insert actually protrudes into the hole means **30** of the arm. The ledge walls **49** engage the bottom walls **28** of the recess **26**, while the sidewalls **47** of the lock engage the sidewalls **27** of the recess. The sidewalls **47** are also upwardly and slightly inwardly inclined to matingly fit the sidewalls of the recess. The longitudinal axis of the block extends parallel to the axis of the hole means **30**. The lower end of the elastomeric body **44** of the lock is received in the recess **35** of the tip and the bottom wall **46** bears against the lugs **36**. The combined depth of the recesses **26** and **35** is slightly less than the thickness of the elastomeric body **44** as taken between the bottom wall **46** and the ledge walls **49**.

The pin **17**, FIGS. **9** to **11**, has a vertical, cross-sectional shape for mating fit with the arm hole means **30** and the tip hole means **40**, and is sized to maintain the tip on the arm in a predetermined manner. As seen in FIG. **4**, the longitudinal dimension of the pin is slightly less than the transverse dimension of the tip **16**, so that the opposite ends may be slightly recessed from the outer tip walls during assembly. The pin **17** includes substantially parallel, opposed, sidewalls **52**, a bottom wall **53** extending substantially normal to the sidewalls, and an upper convex wall **54**. The side and bottom walls are substantially flat. End walls **55** are substantially flat and extend substantially normal to the sidewalls **52**. A cavity **56** is formed in the bottom wall **53** for receiving the metal insert **45** of the elastomeric lock **18** when in assembled position. The cavity is defined by an arcuate or concave wall **57**, and opposed, normally extending, side walls **58**. In order to facilitate the insertion of the pin **17** over the metal insert **45** of the lock, sloping surfaces **59** extend inwardly from the opposite end walls **55** and downwardly to the opposite ends **60** of the cavity **56**. The sloping surfaces **59** are bounded at each edge by walls **61** that facilitate the maintaining of the metal insert **45** along the center of the pin during insertion. Tapered surface walls **62** are provided at opposite ends of the pin to further aid in dividing the movement of the insert toward the walls **61** and ultimately to the cavity **56** during insertion of the pin.

When assembling the tip **16** onto the arm **15**, the rubber lock **18** is first placed into the recess **26** and slot **29** at the end of the arm. The tip is then positioned over the end of the arm, so that the end of the arm fits in the socket **31**, and so the arm hole means and tip hole means substantially coalign. The bottom of the elastomeric lock **18** will then fit into the recess **35** in the bottom wall of the socket tip. Finally, the pin **17** is inserted into either end of the pinway defined by the arm hole means and the tip hole means, and driven into assembled position, as seen in FIG. **4**. The metal insert **45** will snap into the cavity **56** at the center of the pin, and function to retain the pin in position. To disassemble, the reverse order is employed.

Because of the convex sidewalls **33** of the socket **31**, the width of the socket at the center, taken along a plane parallel to the end wall surfaces **32** is shorter than the width taken at the end wall surfaces, thereby defining a larger surface area for the end wall surfaces **32**, which are in bearing contact with the end wall surfaces **23** of the hammer arm. Alternatively, the mating tip sidewall surfaces **33** and arm sidewall surfaces **24** could be tapered or V-shaped, instead of being arcuate. Similarly, the arcuate wall **54** of the pin **17** and the arcuate surfaces **43** of the hole means **40** on the tip **16** could be tapered or V-shaped. In operation, impact on the tip **16** is transmitted to the surface contact between the end wall surface **32** on the tip and the end wall surface **23** on the arm. The present invention thereby provides a maximum of bearing surface on the faces of the tip socket and the arm to greatly enhance the life of the hammer arm.

The construction of the arm and tip also defines thicker side walls **39** of the tip that provide greater bearing surfaces for contact with the pin **17**, together with providing a reduction of load on the pin, as the area of pin shear is closer to the center of the pin.

Inasmuch as the pocket for receiving the elastomeric lock, as defined by the recesses **26** and **35** of the hammer arm and hammer tip, respectively, has a height less than the height of the rubber body **44**, the elastomeric body **44** will fully fill the pocket and possibly slightly fill some of the open areas **37** and the bottom of the recess **35**. Further, the web **50** and position of the metal insert **45** will be of such a dimension that the top edge of the metal insert would normally extend above the position shown with the pin assembled as in FIG. **4**, whereby the lock will perform to firmly hold the metal insert in and against the cavity wall **57** during assembly.

In assembled position, the upper upper, convex wall of the pin **17** engages the upper, convex surface **43** of the tip hole means **40**, while the bottom wall **53** of the pin engages the bottom wall surface **30***b* of the arm hole means **30**. Since the

upper wall 54 of the pin is convex and engages the upper wall surface 43 of the tip which is concave, a greater bearing surface is established between the pin and tip. Such enhances the life of the hammer parts. It will be appreciated that the arm hole means and tip hole means, together with the dimensions of the parts are such as to permit this fit and to draw the tip tightly onto the end of the arm.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim:

1. A hammer for a hammer mill comprising, an arm, a tip, a lock, and a pin, said arm being generally rectangular in cross section and having first and second pairs of opposed sidewalls, hole means transversely extending through said arm adjacent the free end thereof to receive said pin, a recessed area in the very end of the arm to receive one end of the lock, said tip having a socket formed for matingly receiving the end of the arm, hole means extending transversely through the tip and generally aligning with the hole means in said arm and defining a pinway for receiving the pin, a recess in the bottom of the socket to receive the other end of said lock, said lock including an elastomeric body having a metal insert at the one end thereof, said pin being formed with a cross section that mates with the arm and tip hole means and a pin cavity for receiving the metal insert, and said arm, tip, lock and pin being formed so that when assembled, the force of the elastomeric body on the metal insert in engagement with the pin cavity retains said pin in position to lock the tip onto the arm.

2. A hammer as defined in claim 1, wherein one of said pairs of opposed, sidewalls is formed together with the mating surfaces of said socket to provide a greater bearing surface area between the arm and tip.

3. A hammer as defined in claim 2, wherein said formed opposed, sidewalls are concave and the mating surfaces of said socket are convex.

4. A hammer as defined in claim 3, wherein said formed, opposed, sidewalls extend generally parallel to the swinging plane of said hammer.

5. A hammer as defined in claim 1, wherein the mating surfaces of said pin and socket hole means are formed to provide a greater surface area than mating flat surfaces.

6. A hammer as defined in claim 5, wherein the pin mating surface is convex and the hole means mating surface is concave.

7. A hammer as defined in claim 1, wherein the combined depths of said lock recesses is less than the depth of the lock received therein.

8. A hammer as defined in claim 1, wherein the recess for said one end of said lock includes a slot that opens into the pinway, and said metal insert of the lock protrudes through said slot into the pinway.

9. A hammer as defined in claim 1, wherein the pin includes sloping surface extending to the pin cavity for camming the metal insert to a position for snapping into the cavity during assembly of the pin.

10. A hammer as defined in claim 1, wherein the pin includes a pair of symmetrically formed, sloping surfaces extending from each end to the pin cavity for camming the metal insert to a position for snapping into the cavity during assembly of the pin, one or the other of said sloping surfaces camming, depending on the direction of assembly of the pin.

11. A hammer as defined in claim 10, and means on said surfaces for guiding the metal insert therealong during assembly of said pin.

12. A hammer as defined in claim 1, wherein said pin includes an area of shear at the tip socket and said arm and tip are formed to reduce the load on the pin by moving the area of shear closer to the center of the pin.

13. A hammer as defined in claim 1, wherein the recess in bottom of the tip socket includes spaced, upstanding means in the bottom thereof supporting the lock in spaced relation to the recess bottom, thereby defining open areas into which the elastomeric body of the lock may flow when the arm, tip, lock and pin are assembled.

14. A two-part pulverizer hammer for a hammer mill comprising an arm, a removable and replaceable tip, and means for selectively locking the tip onto the arm, said locking means including a pin and a lock, hole means in said tip and hole means in said arm defining a pinway for slideably receiving said pin, socket means within said arm and tip for receiving said lock, and said lock having an elastomeric body and coacting with said pin to retain same in assembled position for locking said tip on said arm.

15. A two-part pulverizer hammer as defined in claim 14, wherein the engaging surfaces of the tip hole means and the pin are formed to provide a greater bearing contact therebetween than mating flat surfaces.

16. A hammer for a hammer mill comprising, an arm, a tip having a socket defined by side and end wall surfaces for mating, interfitting relation with said arm, the mating sidewall surfaces of the tip socket and arm being formed to provide an impact bearing surface between the tip and arm, the width of the socket between the sidewall surfaces taken along a plane parallel to the end wall surfaces and spaced therefrom being shorter than the width taken at the end wall surfaces, thereby defining a greater impact surface than that definable by flat mating sidewall surfaces, means locking the tip onto said arm including hole means extending through the tip and arm defining a pinway and a pin for insertion in said pinway, and the bearing surfaces between the tip hole means and pin being formed to provide a greater bearing contact surface therebetween than mating flat surfaces.

17. a two-part pulverizer hammer as defined in claim 15, wherein one of the engaging surfaces of the tip hole means and the pin is convex and the other engaging surface is concave.