June 7, 1960 T. C. WHISLER, SR 2,939,640

HAMMER WITH REMOVABLE TIP

Filed Aug. 2, 1957 3 Sheets-Sheet 1

FIG. 1

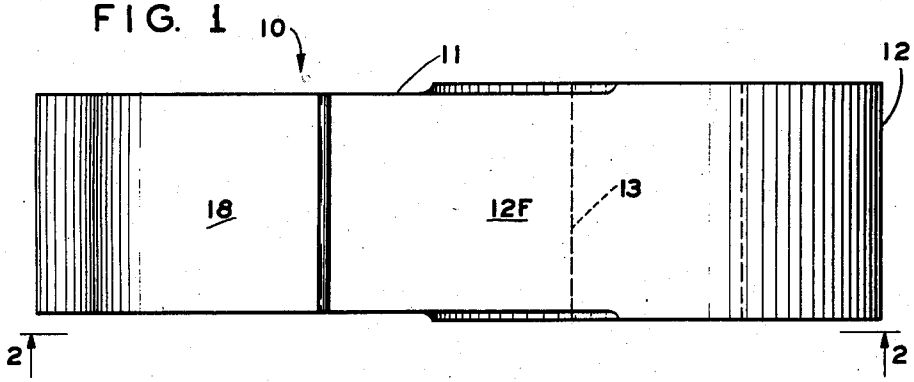
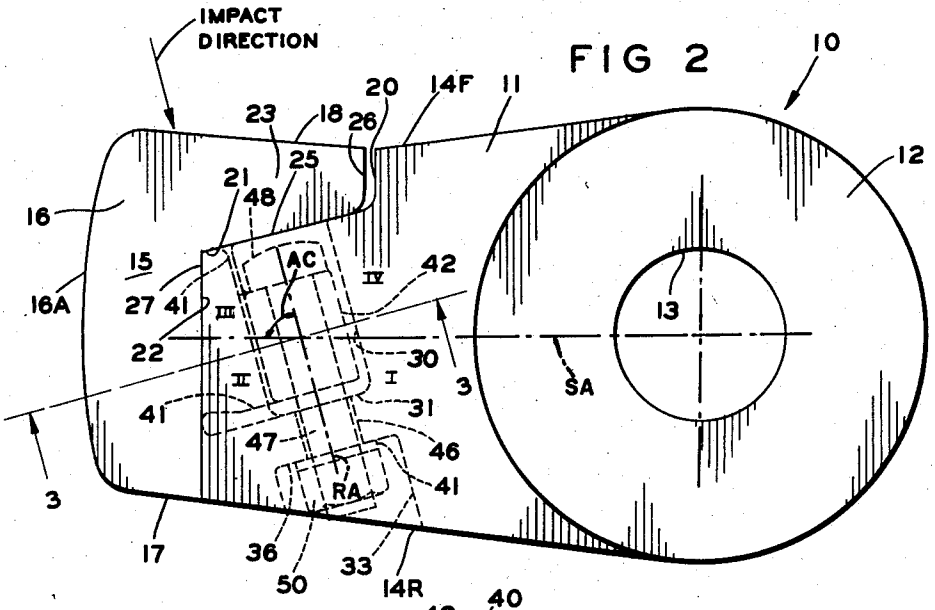


FIG 2



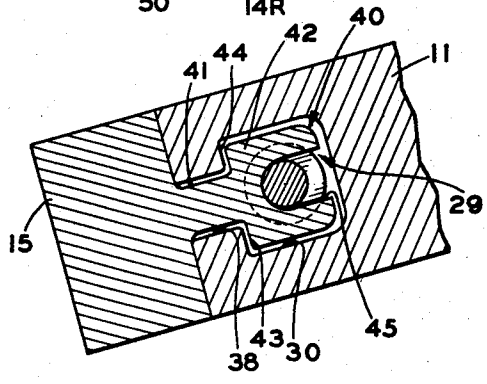


FIG. 3

INVENTOR

THOMAS C. WHISLER, SR.

BY Wallace and Cannon

ATTORNEYS

June 7, 1960 T. C. WHISLER, SR 2,939,640

HAMMER WITH REMOVABLE TIP

Filed Aug. 2, 1957

3 Sheets-Sheet 2

FIG. 6

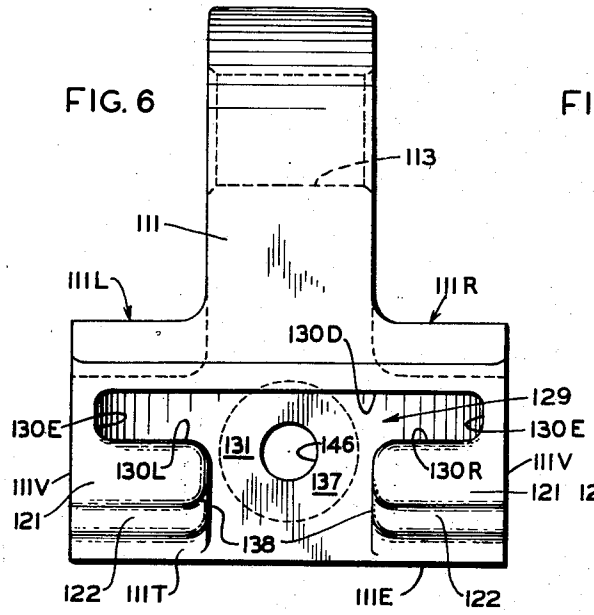
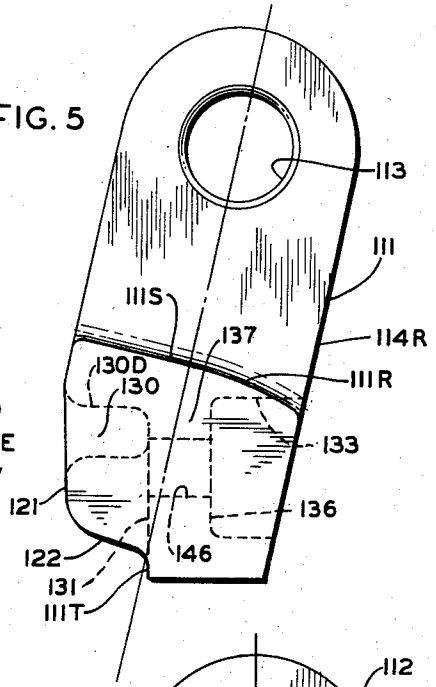


FIG. 5



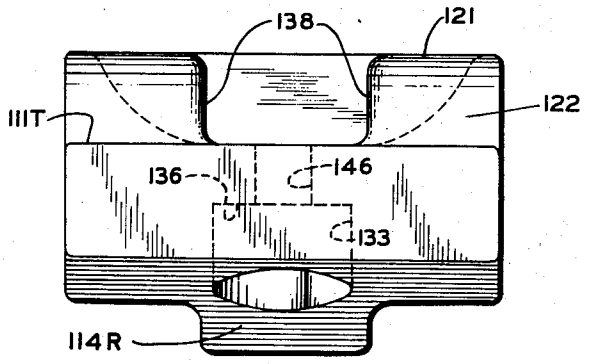


FIG. 6A

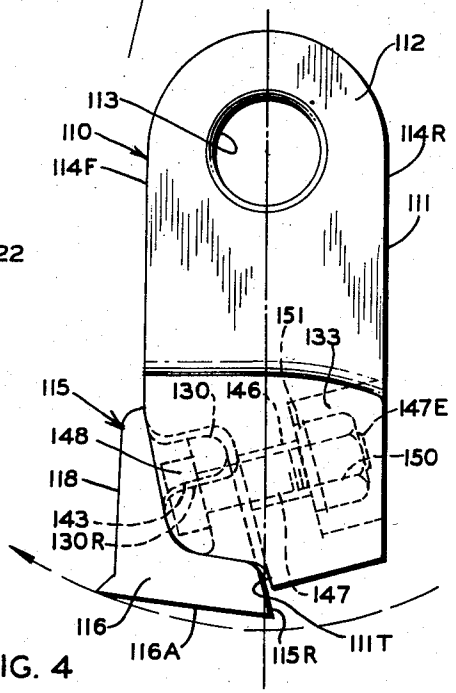


FIG. 4

INVENTOR.
THOMAS C. WHISLER, JR.

BY

Wallace and Cannon

ATTORNEYS

June 7, 1960 T. C. WHISLER, SR. 2,939,640

HAMMER WITH REMOVABLE TIP

Filed Aug. 2, 1957 3 Sheets-Sheet 3

FIG. 7

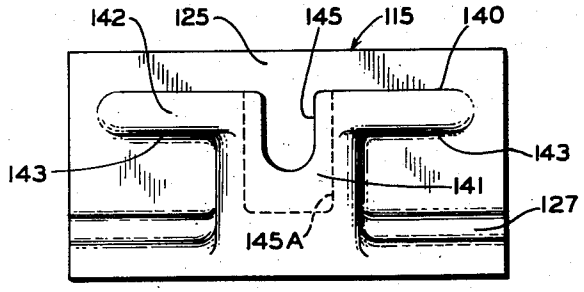
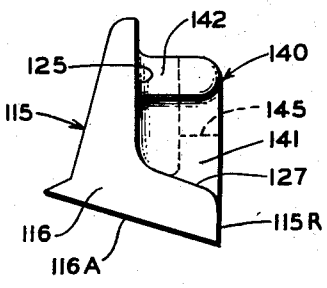


FIG. 8



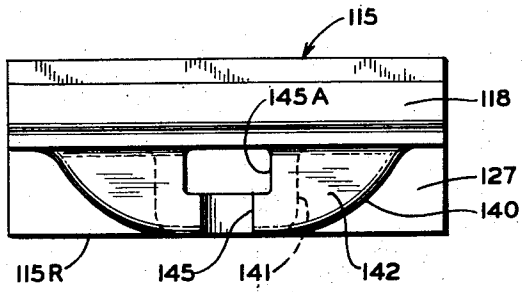


FIG. 7A

INVENTOR.
THOMAS C. WHISLER, JR.

BY
Wallace and Cannon

ATTORNEYS

United States Patent Office 2,939,640 Patented June 7, 1960

2,939,640

HAMMER WITH REMOVABLE TIP

Thomas C. Whisler, Sr., Alameda, Calif., assignor to American Brake Shoe Company, New York, N.Y., a corporation of Delaware

Filed Aug. 2, 1957, Ser. No. 677,178

12 Claims. (Cl. 241—197)

This invention relates to hammers for rotary crushers or pulverizers. This application is a continuation-in-part of my abandoned application Ser. No. 573,666 filed March 26, 1956.

In rotary type crusher mills, a plurality of hammers are arranged circumferentially on a relatively large rotary plate or disc driven by the main shaft of the mill, and the arrangement is such that the hammers are effective to crush and pulverize by impact the ore or other material fed into the mill. With continued operation, the leading end portions of the tips of the hammers where impact occurs gradually wear, and this is manifest in a shortening of the hammer tip which decreases the efficiency of the mill.

Most hammer mills or rotary crushers are originally equipped with one-piece hammers, so that when the tip becomes worn it is necessary to replace the entire hammer part, dismantling the mill and removing the disc and pins on which the hammers are supported. This operation and reassemblage of the mill represent expensive maintenance and lost operating time.

In view of the foregoing, it is advantageous to equip hammers for rotary mills with renewable tips, and the present invention pertains to hammers of this kind. The hammers in a rotary mill rotate at relatively high speed, and it is desirable to maintain as closely as possible a balance of the operating parts so as to reduce objectionable vibration, and as the hammers generally do not wear alike the tendency toward vibration is rather pronounced in some instances. One of the objects of the present invention is to removably mount the renewable tip on the shank of the hammer in such a manner as to enhance the anti-vibrational characteristics of the mill, and further to enable the retaining means for the hammer tip to have the axis thereof disposed generally parallel to or aligned in the direction of impact on the hammer.

One of the principal objectionable features encountered in operation of rotary mills is that in nearly all instances the force generated by the hammer tip impacting the material being crushed tends to drive the tip portion of a renewable hammer radially inward on the shank against the retainer pins or keys that conventionally are used to hold the tip to the shank, and after relatively short working time these retainer keys or pins become distorted, especially when disposed transverse to the direction of hammer rotation, and the hammer shank becomes deformed requiring replacement of these parts. Hammers of this kind of course rotate in but one direction so that the impact forces encountered are localized, and a further object of the present invention is to enable the axis of the retainer to be disposed generally parallel to the direction of hammer rotation while at the same time so relating the renewable tip to the shank of the hammer that relatively large bearing areas are present which effectively absorb the impact forces. Another object of the present invention is to construct the renewable tip of the hammer with a boss which fits into a complemental recess wholly within the shank, thereby safeguarding the boss against

peening and increasing the effective bearing areas between the shank and the tip.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what I now consider to be the best mode in which I have contemplated applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a front elevation of a hammer constructed in accordance with the present invention;

Fig. 2 is a side elevation of the hammer of the present invention taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is a side elevation of another form of hammer constructed in accordance with the present invention;

Fig. 5 is a side elevation of the shank for the hammer of Fig. 4;

Fig. 6 is a front elevation of the hammer shank shown in Fig. 5;

Fig. 6A is a bottom view of the hammer shank of Fig. 6;

Fig. 7 is a rear elevation of the tip for the hammer shown in Fig. 4;

Fig. 7A is a top plan view of the tip shown in Fig. 7; and

Fig. 8 is a side elevation of the tip shown in Fig. 7A.

One form of the present invention is illustrated in Figs. 1 to 3 of the drawings as embodied in a hammer **10** of the kind adapted to be used with a rotary mill, and to this end the shank **11** of the hammer is formed at the head end **12** with a relatively large opening **13** enabling the hammer to be mounted on a corresponding supporting pin carried by a relatively large rotary plate included as basic driving structure in the mill. It will be recognized that the plate or other such supporting means which carry the hammers is adapted to mount a plurality of such hammers in equally spaced circumferential relation.

The front and rear sides **14F** and **14R** of the shank of the hammer are tapered inwardly in the direction proceeding away from the head **12** of the shank, and at the end of the shank opposite the head **12** a renewable tip **15** is provided and is removably mounted thereon in a way now to be described.

The renewable tip **15** includes a wear shoe **16** having an arcuate bottom side **16A** and a rear side **17** which is tapered complementary to and co-planar with the rear side **14R** of the shank **11**. The front side **18** of the tip **15** represents the leading side in the present instance, and in order to compensate for the wear that occurs so as to prolong the life of the tip **15** the front side **18** is tapered in an opposite direction in comparison to the front side **14F** of the shank **11**, which is to say that inasmuch as the impacting force indicated by legend in Fig. 2 is applied to the front side **18** of the tip **15** the front of the tip is provided with surplusage metal forwardly of the front side **14F** of the shank **11**. This is but exemplary, however, since any desired shape may be imparted to the front side of the tip depending upon operating conditions and the material or alloy of which the tip **15** is cast.

The front side **14F** of the hammer shank is undercut to afford a shoulder **20** extending inwardly in the direction of the longitudinal axis of the hammer, and a tapered bearing face **21** that is substantially normal to the direction of impact extends from the shoulder **20** toward the

flat end 22 of the shank 11 which serves as a second bearing face.

The tip 15 includes a front head or flange 23 which is complementary to the front recess in the shank 11 defined by the shoulder 20 and the bearing face 21, so that the tip 15 has a bearing face 25 opposite the bearing face 21 of the shank 11 and a shoulder 26 opposite the shoulder 20 of the shank 11. The tip 15 is also formed with a bearing face 27 complemental to the bearing face 22 of the hammer shank.

As shown in Fig. 3, the shank 11 proceeding inwardly from the bearing face 21 is provided with a generally T-shaped, elongated recess 29 having an enlargement 30 serving as a socket for a complemental part on the tip 15 as will be mentioned below. The recess 29 inwardly of the shank 11 terminates at an internal wall 31 of the shank, and on the side 14R of the shank 11 opposite the bearing face 21 another inwardly extending recess 33 is formed which terminates at an internal end wall 36 of the shank 11 spaced from the aforementioned end wall 31. It will be recognized particularly in Fig. 2 that the longitudinal axes of the recesses 29 and 33 are aligned, and that the axis common to these two recesses is generally parallel to the direction of applied impact force indicated by legend in Fig. 2.

It will be observed in Fig. 3 that the recess 29 includes a neck 38 of reduced dimension, and this neck portion opens at the bearing face 22 of the shank 11 and extends forwardly to the bearing face 21 so that a corresponding slot is provided at the bottom of the shank 11.

Formed on the bearing face 27 of the tip 15 inwardly of the rear end 17 of the tip 15 is an elongated T-shaped boss 40 which extends radially inwardly in relation of the shank 11. This boss includes an inclined neck 41 that is complemental to the slot 38, and the boss 40 additionally includes an enlarged head 42 as shown in Fig. 3 which is complemental to the enlarged portion 30 of the T-shaped recess in the shank 11. The forward end of the head 42 of the boss 40 is spaced from the bearing face 25 of the tip 15, and the neck or web portion 41 of the boss 40 extends to the bearing face 25 as shown in Fig. 2. In mounting the tip 15 to the shank 11 it is merely necessary to align the boss 40 with the T-shaped recess in the shank and then to insert the boss 40 into the recess 29. Thus, the boss 40 includes parallel shoulders 43 between the head 42 and neck 41 engageable with corresponding parallel shoulders 44 afforded by the recess 29, and the head 42 of the boss 40 and the shoulders 43 are inclined parallel to the longitudinal axis of the recess 29 and the shoulders 44. The engageable shoulders 43 and 44 represent the primary support for the head on the shank of the hammer, but initially there may be space therebetween as shown in Fig. 3.

The boss 40 at the end away from the neck 41 is provided with a U-shaped opening 45, Fig. 3, and when the tip 15 is mounted on the shank 11 as mentioned above the recess 45 in the boss 40 is aligned with an aperture 46 that extends between the two end walls 31 and 36. Prior to arranging the tip 15 complementally on the shank 11, a retainer bolt 47 is set in the recess 45 in the boss 40 so that the head 47 thereof is disposed against the end of the head of the boss 40 opposite the bearing face 25 of the tip 15 so as to pass through the opening 46, and in this way the head of the bolt is shieldably disposed inwardly of the tip 15. After the tip 15 has been complementally related to the shank 11, the threaded end of the bolt opposite the head 47 thereof is shieldably disposed within the recess 33 and a nut 50 and a lock washer 51 are then mounted on the threaded end of the bolt and the nut 50 is tightened to securely associate the tip 15 with the shank 11 of the hammer.

Another hammer embodying the features of the present invention is illustrated at 110 in Fig. 4, the hammer 110 including a shank 111 formed at its head 112 with an enlarged opening 113 for the purpose described above. The sides 114F and 114R of the shank respectively, represent the front and rear sides of the shank of the hammer, assuming the hammer to be rotated in the direction indicated by arrow in Fig. 4. The shank 111 is provided with a renewable tip 115 on the front side thereof and at the end opposite the head 112.

The tip 115 includes a bottom wear shoe 116 having a substantially flat bottom side 116A, and the tip further includes a substantially flat front side 118 which takes the impact encountered in mill operation. Thus, the front side 118 of the tip 115 represents the leading side or face, and in order to compensate for impact in the manner described in connection with the foregoing embodiment of the invention, it will be seen that a substantial amount of surplusage metal is provided at what constitutes the apex of the tip 115.

As best shown in Fig. 6, the hammer shank 111 is formed with outwardly directed left and right hand shoulders 111L and 111R. These shoulders have sloped upper surfaces 111S, Fig. 5, and the outer or free side surfaces of the shoulders 111L and 111R lie in substantially true flat vertical planes 111V, Fig. 6.

It will be readily recognized from Fig. 6 that the shank 111 is somewhat in the nature of an inverted T-member affording a forward bearing face 121 of generous area which is interrupted by a relatively large generally T-shaped recess which will be described in more detail hereinbelow. Referring to Fig. 5, it will be observed that the shank 111 has a second or end bearing face 122 extended somewhat normal to the forward bearing face 121. Thus, the bearing face 122 is in effect a bearing face at the end of the shank 111 opposite the head 112, and the bearing face 122 is afforded by terminating the shoulders 111L and 111R short of the lower extreme end 111E, Figs. 5 and 6, of the shank 111. Such construction provides what can be viewed as a thrust surface 111T at the lower end of the hammer shank relative to which the rear end 115R, Fig. 4, of the tip 115 will normally be spaced. The spacing between the surfaces 111T and 115R can be viewed as a take-up space. It will also be observed in Fig. 4 that surfaces and projections to be described hereinafter are also suitably configured for such relative movement between the tip and the shank. It will moreover be appreciated that such dimensioning of the parts facilitates casting. Referring to Fig. 8, the tip 115 includes bearing faces 125 and 127 that are complemental to the bearing faces 121 and 122 of the hammer shank. Engageability of the bearing faces will be described in more detail below.

The T-shaped recess formed in the forward bearing face 121 of the shank is indicated at 129 in Fig. 6. The recess 129 includes a transverse portion 130, Fig. 5, defined by a downwardly facing surface 130D that extends inwardly from the forward bearing face 121 of the hammer shank, end surfaces 130E, Fig. 6, and spaced apart lower surfaces 130L and 130R which afford left and right hand shoulders for a purpose to be described. The transverse portion 130 of the recess 129 communicates with a vertical neck portion 138, Fig. 6, the neck portion 138 extending all the way to and opening at the lower bearing surface 122 of the hammer shank. As will be observed in Fig. 6A, the ends of the recess 130 become progressively shallow proceeding outwardly from the neck portion 138.

The recess 129 terminates at an internal wall 131, Figs. 5 and 6, and on the side 114R of the shank 111 opposite the bearing face 121 another inwardly extending recess 133, Fig. 5, is provided which terminates at an internal end wall 136 of the hammer shank spaced from the end wall 131 by a solid web portion 137. It will be recognized particularly in Figs. 4 and 5 that the recesses 130 and 133 are aligned and that the axes thereof are common and inclined relative to the vertical center line of the shank 111. This disposes the shoulders 130L and

130R to point generally in the direction of concentrated impact on the hammer tip as described above.

The hammer **115**, as mentioned, includes bearing faces **125** and **127** respectively complemental to the bearing faces **121** and **122** of the hammer shank so as to flatly engage therewith as indicated in Fig. 4. It was also mentioned that the bearing faces of the shank are interrupted by a recess **129**, and likewise the bearing faces of the tip **115** are interrupted by a T-shaped boss **140**, Figs. 7 and 8, which is adapted to fit complementally in the T-shaped recess **129** of the shank **111**. Thus, the boss **140** includes a neck **141** which projects vertically from and is centered medially on the bearing face **127** of the tip **115**. The neck **141** of the T-boss **140** is provided at the upper end thereof with an enlarged transverse head **142** complemental to the transverse portion **130** of the recess **129** in the hammer shank.

It will be seen that the renewable hammer tip **115** is fully complemental to substantially all forward area portions of the hammer shank between what has been termed the thrust face or surface **111T** and the forward upper sections of the shoulders **111L** and **111R** of the hammer shank. Accordingly, the hammer tip and shank are adapted to be complementally engaged and fitted together in the manner illustrated in Fig. 4 with the neck of the T-boss disposed in the neck portion **138** of the hammer shank recess **129**, and with the crosshead **142** of the T-boss disposed in the portion **130** of the hammer shank recess **129**. When the parts have been properly fitted together in this manner, the bearing face **125** of the hammer tip engages the front bearing face **121** of the hammer shank, and the bearing face **127** of the hammer tip engages the end bearing face **122** of the hammer shank. The lower surfaces **143**, Fig. 7, of the crosshead **142** constitute downwardly facing shoulders, and these as viewed in Fig. 4 are sloped to point generally in the direction of impact as described above in connection with the hammer **10**. As in the instance of the hammer **10**, all portions of the T-boss on the hammer tip **115**, particularly the shoulders **143**, are wholly confined by and within the hammer shank, which is to say that the side sections of the hammer shank, which in this instance are represented by the side walls of the shoulders **111L** and **111R**, completely cap and shroud the attaching boss **140**. As in the instance of the hammer **10**, the shoulders of the T-boss on the tip are juxtaposed above the complemental internal shoulders or surfaces of the shank, **130L** and **130R** in this instance, and this constitutes the primary mode of mounting the tip to the hammer shank.

Openings are formed in the hammer shank and the T-boss, and when the parts are complementally fitted together in the manner illustrated in Fig. 4, these openings register and are adapted to take a retainer means for removably securing the hammer tip to the shank. Thus, an aperture **146**, Fig. 5, is extended through the web portion **137** of the hammer shank which separates the recesses **129** and **133**, the opening **146** being centered relative to the recess **129** as shown in Fig. 6. A U-slot **145**, Fig. 7, is formed in the medial portion of the T-boss **140**, and the U-slot **145** registers with the opening **146** in the hammer shank when the parts are assembled as shown in Fig. 4. Referring to Fig. 7A, it is to be noted that the U-slot **145** communicates with an enlargement **145A**, the enlargement **145A** having both a greater width and a greater depth than the U-slot **145** as will be seen in Fig. 7.

The retainer means is similar to the retainer means described in the embodiment of Figs. 1 to 3, and thus is conveniently in the form of a nut and bolt assembly including a bolt **147**, Fig. 4, having a head **148** and a threaded end **147E**, a nut **150**, and a lock washer **151**. Prior to assembly, the shank of the bolt **147** is reposed in the U-slot **145** of the hammer tip boss with the head **148** of the bolt reposed in the enlargement **145A**. As a consequence, the threaded end of the bolt is disposed outwardly of the T-boss **140**. The tip **115** having the bolt thus mounted therein is then associated with the hammer shank so that the threaded end of the bolt passes through the opening **146** therefor in the web **137** of the hammer shank, whereby the threaded end **147E** of the bolt is disposed in and wholly confined protectively within the recess **133** at the rear side or face of the hammer shank. The lock washer **151** is then associated with the end of the bolt within the recess **133**, whereupon the nut **150** is then tightened to firmly draw the hammer tip **115** up on the hammer shank to bring the respective bearing faces of the tip and hammer shank into tight engagement. Preferably the openings **145** and **146** are so oriented that the axes thereof point, together with the complemental internal shoulders of the tip and shank, in the direction of concentrated impact on the hammer tip during use of the hammer. In any event, it will be appreciated that the retainer means has the axes thereof disposed to travel generally parallel to the direction of hammer rotation rather than transverse thereto.

It will be seen from the foregoing that under the present invention the opposed bearing faces of the tip and the shank of the hammer are of relatively large area and that these are provided at areas where the impacting forces are concentrated so as to increase substantially the ability of the hammer to absorb and dissipate the impact forces. The retaining bolt that is used to hold the tip to the shank is arranged so that its axis travels generally parallel to the direction of hammer rotation, and preferably so that its axis points generally in the direction of the major applied impact force. In this way, vibration of the hammer is reduced to a minimum. The relation between the longitudinal axis of the shank and that of the retaining means in both forms of the invention can be readily realized by reference to Fig. 2 of the drawings wherein the longitudinal axis of the shank is indicated at SA and that of the retainer means at RA. These axes intersect, or will do so if projected, and the usual four quadrants result as indicated at I, II, III and IV numbering clockwise in the standard geometrical fashion from the upper right-hand quadrant. Due to the inclination of the axis RA of the retainer means, the angle AC enclosed by the intersecting axes in the third quadrant III is an acute angle, and the same relationship holds true for the hammer as illustrated in Fig. 4. As will be observed particularly in Figs. 3 and 4, the boss on the hammer tip is wholly confined by the hammer shank. This protects the boss and its neck against peening and further assures that the bearing faces of the tip and hammer shank are of maximum effective area.

Hence, while I have illustrated and described preferred embodiments of my invention, it is to be understood that these are capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A hammer for a rotary mill comprising, a shank having a head adapted to be carried by a rotary part of the mill, said shank having a recess in one side of the shank affording a shoulder extending inwardly from said side and affording a forward facing bearing face in a plane generally normal to the direction of impact and extending from the inner end of the shoulder to the end of the shank opposite the head, said end of the shank opposite the head serving as a second bearing face on the shank, a renewable tip on the end of the shank opposite the head and having bearing faces complemental to said bearing faces of the shank, said shank having an elongated T-shaped recess formed therein which proceeds inwardly from the first-named bearing face along an inclined axis pointing generally in the direction of impact, said renewable tip on the bearing face thereof that is complemental to the second-named bearing face

of the shank having a boss projecting therefrom that is complemental in shape and inclination to and fitted in the T-shaped recess in the shank, said shank having another recess in the shank formed inwardly from the side of the shank opposite that having the first-named bearing face and spaced from the inner end of the T-shaped recess in the shank by an intervening wall, said boss and said intervening wall having aligned openings therein on a common inclined axis also pointing in the direction of the impact force, and bolt means passed through said aligned openings to removably hold the tip to the shank of the hammer, one end of said bolt means being shielded by the second-named recess in the shank and the other end of the bolt means being shielded by the renewable tip.

2. A hammer for a rotary mill comprising, a shank having a head adapted to be carried by a rotary part of the mill, a forward facing bearing face on one side of the shank and terminating at the end of the shank opposite the head, said end of the shank opposite the head serving as a second bearing face on the shank, a renewable tip on the end of the shank opposite said head and having bearing faces complemental to said bearing faces of the shank, said shank having a recess formed therein affording shoulders that point in the direction of impact, said renewable tip on the bearing face complemental to the second-named bearing face of the shank having a boss projecting therefrom that affords shoulders complemental to the shoulders afforded by the recess in the shank, said shank having another recess in the shank formed inwardly from the side of the shank opposite the first-named bearing face and spaced from the first-named recess in the shank by an intervening wall, said boss and said intervening wall having aligned openings therein on a common inclined axis pointing in the direction of impact, and bolt means passed through said aligned openings to removably hold the tip to the shank of the hammer, one end of said bolt means being shielded by the second-named recess in the shank.

3. A hammer for a rotary mill comprising, a shank, a forward facing bearing face on one side of the shank extending to one end of the shank, said end of the shank serving as a second bearing face, a renewable tip on said end of the shank and having bearing faces complemental to said bearing faces of the shank, said shank having a T-shaped recess formed therein proceeding inwardly from the first-named bearing face, the axis of said recess being inclined so as to point in the direction of impact, said renewable tip on the bearing face complemental to the second-named bearing face of the shank having a T-shaped boss projecting therefrom that is complemental to and fitted in the T-shaped recess in the shank so as to be inclined to point in the direction of impact, and bolt means passed through aligned openings in said boss and shank to removably hold the tip to the shank of the hammer, the axis of said bolt means being inclined so as to point in the direction of impact.

4. A hammer for a rotary mill comprising, a shank, a forward facing bearing face on one side of the shank extending to one end of the shank, said end of the shank serving as a second bearing face, a renewable tip on said end of the shank and having bearing faces complemental to said bearing faces of the shank, said shank having a T-shaped recess formed therein proceeding inwardly from the first-named bearing face, the axis of said recess being inclined so as to point in the direction of impact, said renewable tip on the bearing face complemental to the second-named bearing face of the shank having a T-shaped boss projecting therefrom that is complemental to and fitted in the T-shaped recess in the shank so as to be inclined to point in the direction of impact, and retainer means passed through aligned openings in said boss and shank to removably hold the tip to the shank of the hammer, the axis of said retainer means being inclined so as to point in the direction of impact.

5. A hammer for a rotary mill comprising, a shank having a head adapted to be carried by a rotary part of the mill, one side of the shank affording a forward facing bearing face extending to the end of the shank opposite the head, said end of the shank opposite the head serving as a second bearing face on the shank, a renewable tip on the end of the shank opposite the head and having having bearing faces complemental to said bearing faces of the shank, said shank having an elongated recess formed therein which affords inclined shoulders proceeding parallel inwardly from the first-named bearing face along a line pointing generally in the direction of impact, said renewable tip on the bearing face thereof that is complemental to the second-named bearing face of the shank having a boss projecting therefrom that is complemental to the recess in the shank so as to afford shoulders above the shoulders afforded by said recess, said shank adjacent the recess having an opening for receiving a retainer, said boss having an opening therein aligned with said opening in the shank and said openings having a common inclined axis pointing generally in the direction of impact, and retainer means passed through said aligned openings to removably hold the tip to the shank of the hammer.

6. A hammer for a rotary mill comprising, a shank having a head adapted to be carried by a rotary part of the mill, a forward facing bearing face on one side of the shank and terminating at the end of the shank opposite the head, said end of the shank opposite the head serving as a second bearing face on the shank, a renewable tip on the end of the shank opposite said head and having bearing faces complemental to said bearing faces of the shank, said shank having a recess formed therein affording spaced apart parallel shoulders that point in the direction of impact, said renewable tip on the bearing face complemental to the second-named bearing face of the shank having a boss projecting therefrom that affords spaced apart parallel shoulders complemental to and engageable with the shoulders afforded by the recess in the shank, said shank having another recess in the shank formed inwardly from the side of the shank opposite the first-named bearing face and spaced from the first-named recess in the shank by an intervening wall, said boss and said intervening wall having aligned openings therein on a common axis pointing in the direction of impact, and retainer means passed through said aligned openings to removably hold the tip to the shank of the hammer, one end of said retainer means being shielded by the second-named recess in the shank and the other end of said retainer means being shielded by the renewable tip.

7. A hammer for a rotary mill comprising, a shank having a longitudinal axis, a forward facing bearing face on one side of the shank extending toward one end of the shank, said end of the shank serving at least in part as a second bearing face, a renewable tip on said end of the shank and having bearing faces complemental to said bearing faces of the shank, said shank having a recess formed therein proceeding inwardly from the first-named bearing face, said recess affording shoulders which are inclined so as to point generally in the direction of impact and disposed wholly internally of said shank, said renewable tip on the bearing face complemental to the second-named bearing face of the shank having a boss projecting therefrom formed with shoulders complemental to the shoulders afforded by said recess in the shank so as to point generally in the direction of impact, and retainer means passed through aligned openings in said boss and shank to removably hold the tip to the shank of the hammer, said retainer means being aligned on an axis which intersects said axis of the shank and which is so inclined relative to said axis of said shank as to define an acute angle in the third quadrant produced by said intersecting axes.

8. A hammer for a rotary mill comprising, a shank

having a longitudinal axis, a forward facing bearing face on one side of the shank extending toward one end of the shank, said shank having a second end bearing face disposed substantially normal to the first-named bearing face, a renewable tip for the shank and having bearing faces complemental to said bearing faces of the shank, said shank having a recess formed therein proceeding inwardly from one side of the shank, said recess affording shoulders which are inclined so as to point generally in the direction of impact and disposed wholly internally of said shank, said renewable tip having a boss projecting therefrom formed with shoulders complemental to the shoulders afforded by said recess in the shank so as to point generally in the direction of impact, and retainer means passed through aligned openings in said boss and shank to removably hold the tip to the shank of the hammer, the longitudinal axis of said retainer means being disposed on a line which intersects said axis of said shank and which is so inclined relative to said axis of said shank as to define an acute angle in the third quadrant produced by said intersecting axes, and said shoulders all extending parallel to said axis of said retainer means.

9. A hammer for a rotary mill comprising, a shank, a forward facing bearing face on one side of the shank extending toward one end of the shank, said end of the shank serving at least in part as a second bearing face, a renewable tip on said end of the shank and having bearing faces complemental to said bearing faces of the shank, said shank having a recess formed therein proceeding inwardly from the first-named bearing face, said recess affording shoulders which are disposed wholly internally of said shank and inclined so as to point generally in the direction of impact, said renewable tip on the bearing face complemental to the second-named bearing face of the shank having a boss projecting therefrom formed with shoulders complemental to the shoulders afforded by said recess in the shank and disposed wholly within the recess in the shank, and retainer means removably holding the tip to the shank of the hammer.

10. A hammer for a rotary mill comprising, a shank, a renewable tip for the shank, said shank having an internal recess formed therein in the shape of the letter T and proceeding inwardly from an outer surface of the shank, said recess affording at least four internal surfaces disposed wholly internally of the sides of the shank, said renewable tip having a boss projecting therefrom formed with external surface complemental to the internal surfaces afforded by said recess in the shank, said boss on the tip being seated in the recess of the shank with said internal surfaces and said external surfaces in juxtaposition thereby mounting the tip on the shank of the hammer, and retainer means removably holding the tip to the shank of the hammer.

11. A hammer for a rotary mill comprising, a shank having a longitudinal axis, a forward facing bearing face on one side of the shank extending to one end of the shank, said end of the shank serving as a second bearing face, a renewable tip on said end of the shank and having bearing faces complemental to said bearing faces of the shank, said shank having a recess formed therein proceeding inwardly from one side thereof, said recess affording spaced shoulders disposed wholly internally of said shank, and the axis of said recess being inclined so as to point generally in the direction of impact, said renewable tip having a boss projecting therefrom that is complemental to and fitted in the recess in the shank so as to be inclined to point generally in the direction of impact, and retainer means passed through aligned openings in said boss and shank to removably hold the tip to the shank of the hammer, said retainer means being aligned on an axis which intersects said axis of the shank and which is so inclined relative to said shank as to define an acute angle in the third quadrant produced by said intersecting axes.

12. A hammer for a rotary mill including a shank having a recess and an internal shoulder, said shank having a longitudinal axis, a tip for the shank and having a boss formed complemental to the recess and shoulder of the shank, said shoulder being inclined to point generally in the direction of impact on the tip, and retainer means holding the tip to the shank and having the axis thereof disposed on a line which intersects said axis of said shank and which is so inclined relative to said axis of said shank as to define an acute angle in the third quadrant produced by said intersecting axes.

References Cited in the file of this patent

UNITED STATES PATENTS

1,717,759	Briggs	June 18, 1929
2,467,865	Smith	Apr. 19, 1949
2,534,302	Sennholtz	Dec. 19, 1950
2,566,758	Anderson	Sept. 4, 1951