ABSTRACT: The process of manufacture of a hammermill hammer from a blank which comprises punching the blank with a larger punch to form a hole in the blank into which a cylindrical hammer-supporting rod can be loosely and freely received, and then punching the blank again with a second punch to form a recess in the wall of the hole made in the first punching to form an enlarged finished hole, the second punch having a certain side surface portion in the form of the convex outer surface of the cylinder of the same size as the hammer rod so that a hammer rod passing laterally of itself can pass through said hole from its larger part into the recess for snug engagement with the wall of the recess.
PROCESS OF MANUFACTURE OF HAMMERMILL HAMMERS

CROSS-REFERENCE TO RELATED APPLICATION

An application by the same inventors related to this application is filed substantially at the same time as this application and is titled: HAMMERMILL HAMMER AND ASSEMBLY.

FIELD OF THE INVENTION

This invention is in the field of hammerrmill hammer manufacturing.

DESCRIPTION OF THE PRIOR ART

In the prior art it has been customary to manufacture hammermill hammers by punching circular openings in the hammers while a hammer blank is supported on a punching die with an opening therethrough, such holes have always been of cylindrical shape.

It had been the applicants' conception that a hammer could be produced having a much greater bearing surface for engaging the hammer-supporting rod in a hammermill than had heretofore been made.

It is necessary that the hole in the hammermill hammer be larger than the area of the supporting rod in order that hammers fit the rods sufficiently loosely as to enable the hammers to be slid along the rods with ease for keeping the labor time required for hammer installation at minimum.

It is for that reason that prior art hammers have had holes therethrough which were of diameters each substantially greater than the rod on which it is to be received.

This has caused that wall surface of the hole in a prior art hammer which actually touches and bears against the rod to be of very, very small area, resulting in a concentration of pressure along the line at which the rod is tangent to the cylindrical wall surface of the hole.

Cylindrical force along this line at high revolutions per minute had caused pressure on the hammer to exceed the tensile strength of the hammer material, causing cracking to spread from the line outwardly until the hammer has cracked away.

We had conceived of a hammer in which the bearing wall portion of the hole in the hammer disposed closest to one end of the hammer would be a recess in the wall of the hole having the shape of a portion of the curved surface of a cylinder for receiving the cylindrical hammermill attachment rod snugly thereagainst to provide a greater bearing surface to extend hammer life.

We had further conceived that the bearing wall surface or recess wall of the hammer hole should not be of the shape of more than half of the curved surface of a cylinder in order to permit the rod to pass into that part of the hammer hole which is bounded by the bearing wall portion, and further that the remainder of the hammer hole be enlarged so that it might be possible for a cylindrical hammer rod, of substantially the radius of the bearing surface portion of the hammer hole, to pass freely through the hole.

It is customary and economical to manufacture hammers by punching out their holes. It is also customary that the die have a punch-receiving opening which is somewhat larger in diameter than the punch because if this clearance is not available, then it is impossible to punch out a portion of a blank and so our plans for forming a hammer with a hole of this particular shape seemed to involve two punchings with different sized punches with each punching being supported by a die with a punch-receiving die opening of a slightly larger size than the punch it receives.

Therefore, it appeared that a first punching would be made by a smaller punch having a radius which would be the desired radius of the bearing wall surface or recess wall of the finished hammer hole and then, secondly, to punch out the remainder of the finished hammer hole with the larger punch, again using a die having an opening slightly larger than the second punch for providing clearance to allow the slug punched out to pass freely through.

But the difficulty involved is that the desired cylindrical surface of the bearing wall or rod receiving recess of the finished hole is not cylindrical, but instead tapers so as to be actually frustoconical, and of larger area and size on the die side of the blank.

The resultant product would then have a cylindrical bearing wall surface or recess wall and would engage a hammer attachment rod only along a thin line of partial circle shape and the pressure of the hammer rod against the hammer along this partial circular line would result in a concentration of pressure which could exceed the tensile strength of the hammer causing cracking and destruction of the hammer.

SUMMARY OF THE INVENTION

This problem was finally solved by the conception of a process of manufacture of a hammermill hammer which comprises punching the blank with a first punch to form a hole in the blank large enough for the hammer rod to move loosely and freely therethrough and then, secondly, punching the blank with a punch having a certain side surface portion in the form of a convex outer surface of the cylinder, this portion forming a recess in the side surface of the hole made by the first punching to form a finished hole of the type described, the die used in the second punching having a punch receiving opening having a particular side portion of substantially the shape and size of the certain side surface of the second punch for receiving the certain side surface of the second punch, the particular side portion of the second receiving opening being so close to said second punch as it passes by as to cause the wall of the resultant recess to be substantially of the shape of a portion of a cylinder rather than tapered.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevation of a first punch and die set with the blank for making a hammer mounted thereon, a slug which has been punched from the blank being shown, the die end blank having the forward portions broken away and the remainder showing in section.

FIG. 2 is a view similar to FIG. 1, but of a second punch and die set and a second slug which has been punched out.

FIG. 3 is a top plan view of a finished hammer showing a finished hole therein in full lines, the position of an inner side of the second die during punching being diagrammatically illustrated in dotted lines.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a hammermill hammer blank is there shown at 10 as it would look with its forward half broken away after a slug 20 has been punched therefrom, leaving a hole 30. In the illustration shown, a punch 40 which has punched the hole 30 is of twenty-five thirty-seconds inch in diameter as measured at A and a supporting die 60 as the first punch-receiving opening 70 for receiving the cylindrical die 40, the opening 70 having a diameter shown at B, which, for example, is fifty-one sixty-fours inch somewhat larger than the diameter of the punch 40, so as to allow the slug 20 to pass freely therethrough to make the punching possible.

As thus described the hole 30 will be found to have a wall surface of frustoconical shape, being of a diameter at its upper side of the diameter of the punch 40 and of a diameter at its lower side of substantially the diameter of the die opening 70.

The punched out slug 20 likewise therefore is of frustoconical shape, as shown in FIG. 1.

It is generally recognized that it is impossible to punch a slug out of a blank of any substantial thickness in a single punching, if that punching is an initial punching, without having the die opening 70 of substantially larger size than the diameter of the punch so as to make the punching possible.
Referring to FIG. 2, the blank 10 is there shown in a position such that its hole 30 formed by the first punch 40 is disposed off set to one side of a second die opening 100 in a second die 102 while the blank 10 is rested thereon, so that a second punch 120 punching down through the blank 10 and through the second die opening 100 will form a recess 130 in the wall of the blank 30 to enlarge the hole 30 to make the finished hole, which is generally indicated at 150.

The second punching by the punch 120 is made so that the punch overlaps that wall of the hole 30 which is closest to one end 160 of the blank whereby the second punch 120 can be said to have a certain side surface portion 180 in the form of the convex outer surface of a cylinder and the recess 130 being formed by a certain side surface 180 of the punch 120 will have the same shape as the side surface 180 of the punch 120 as is possible because the punch 120 and its die opening 100 are of the same size or of substantially the same size and shape.

The second punch 120 has a diameter C which can be, for example, three-fourths inch which is identical to the diameter D of the opening 100. The only reason the second slug 190 can be punched without more clearance between the wall of the opening 100 and the second punch 120 is because the slug can escape through the preliminary hole 30 as is our discovery.

Since the certain side surface 180 is of the shape or form of the convex outer surface of a cylinder, and since the die opening 100 is the same identical size and shape, then the wall surface 200 of the finished hole 150 which is punched out by the second punch 120 will be substantially of the shape of a convex portion of a cylinder and will not be tapered as is the opening 30, and defines not more than one-half of the circumference of a cylinder.

It is important that the size and shapes of the two punches 40 and 120 and the overlapping of the positions of the punches with respect to the end 160 of the blank be such that a cylindrical rod, not shown, but which can be considered to occupy substantially the position of the wall 200 of the recess 130 on one of its sides, and on the other of its sides, the dotted line 250 of FIG. 3, such rod being of the same diameter as the second punch 120, can be inserted freely and loosely into the finished hole 150 while being mostly received in that part of the finished hole which is shown at 30, as made by the larger punch 40, and then thereafter the rod, shown only in dotted lines at 250, can be passed transversely of itself into a position such that it snugly engages the wall surface of the recess 130, as shown in FIG. 3.

It is this latter position of the finished hammer 300 with respect to the hammer supporting rod 250, that these two members assume with respect to each other during the operation in the hammermill, whereby the cylindrical wall 200 of the recess 130 snugly engages substantially identically diametered hammer attachment rod 250 for giving excellent maximum bearing surface for distributing the pressure of the rod 250 against the hammer 300 to prevent concentration of pressure and cracking of the hammer.

We claim:

1. The process of manufacture of a hammermill hammer from a blank which comprises forming a preliminary hole through said blank, and then thereafter punching the blank with a recess-making punch to form a recess in the wall of said hole to form an enlarged finished hole, said recess wall and the wall of said preliminary hole extending between the same sides of said blank, the said recess-making being done while the blank is supported by a recess-making punch-receiving die having a recess-making punch-receiving opening therein, said recess-making punch having a certain side surface portion in the form of the convex outer surface of a cylinder and said recess being formed by said certain side surface portion, said recess-making punch-receiving opening having a particular side portion having substantially the shape and size of said certain side surface portion of said recess-making punch so that said recess-making punching causes a substantial portion of the wall of said recess to be substantially cylindrical rather than tapered, the portion of said blank punched out by said recess-making punch leaving said blank by partly passing through the said preliminary hole, the length of that recess wall portion of said finished hole which is formed by said recess-making punch defining not more than one-half the circumference of a cylinder, the removal material from said blank during the forming of said preliminary hole and during the forming of said recess being such that a cylindrical rod of the same radius as the radius of the said certain side surface portion of said recess-making punch can be inserted freely and loosely through said finished hole while being mostly received in that part of the finished hole which lies outside of said recess and then thereafter said rod can be passed transversely of itself into a position such that it snugly engages the wall surface of said recess.

2. The process described in claim 1 in which said preliminary hole is formed in said blank by punching said blank with a preliminary hole-making punch, the said first punching being done while the blank is supported by a first die having a preliminary-hole-making punch-receiving opening of sufficiently greater size than the preliminary-hole-making punch so as to allow the punched out portion of the blank to pass from the blank.

3. The process of claim 1 in which the said blank is formed of plate material having two large flat parallel sides and in which said preliminary hole is made through said blank from one of its large flat sides to the other, said recess-making punch below being in a direction at a right angle to the larger flat parallel sides of the blank.