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54 Casting for impact clutch hammer frame and method of manufacturing same.

57 A casting for an impact clutch hammer frame is described wherein the method of casting and structure promotes directional solidification. This is accomplished by improving the supply flow of molten metal to the casting and minimising the casting volume towards one critical end while pouring from the other end in a vertically downward position, the resulting casting being particularly free of voids in the critical end.

This invention relates generally to hammer cage members for rotary impact tools and the like. In particular, this invention relates to a rotary impact mechanism hammer cage or frame of the type generally described in US-A-3,661,217 issued to Spencer B. Maurer, May 9, 1972.

Briefly, the invention therein relates to a rotary impact tool and a clutch therefor wherein a motor drives a cage or frame member within which is pivotally mounted a swinging hollow hammer member. An output shaft extends through the cage member and through the hollow member and includes forward and reverse impact anvil surfaces.

The hammer member is mounted to swing in respect to the cage as it rotates with the cage and it carries forward and reverse impact jaws on its internal surface. As the clutch is driven in the forward direction by an air motor or the like the forward impact jaw is moved in and out of the path of the anvil jaw on the output shaft by cam action and during an impact blow the inner shell of the rotating hammer member acts also as automatic means to hold the impact jaw in engagement with the anvil jaw.

Upon impact, the cage member is stressed and it is again stressed during reacceleration of the hammer members. The hammer cage or frame, therefore, sees cyclic stress in service and its life has been found to be related to the design and soundness of the cage structure.

According to one aspect of the present invention, there is provided a casting for an impact hammer frame comprising a generally rectangular box having a driven end and a non-driven end, and two open and two closed side walls; said casting being provided with a means for facilitating end to end boring in each of said closed side walls; characterised in that said means for facilitating boring is tapered in at least one direction to provide a means for promoting casting material flow during solidification so as to accomplish directional solidification from said driven end to said non-driven end during cooling.

According to another aspect of the present invention, there is provided a hammer frame manufactured from a directionally solidified casting, comprising a generally rectangular box having a driven end and a non-driven end, and two open and two closed side walls; said casting being provided with a means for facilitating end to end boring in each of said closed side walls; characterised in that said means for facilitating boring is tapered in at least one direction to provide a means for promoting casting material flow during solidification so as to accomplish directional solidification from said driven end to said non-driven end during cooling; and said hammer frame has been manufactured by first boring through said means for facilitating boring and thereafter removing said means for facilitating boring to partly expose the bore.

For a better understanding of the invention and to

show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a non-driven end view of an impact hammer frame casting according to the prior art; Figure 2 is a driven end view of a hammer frame according to the prior art;

Figure 3 is a side elevation view of a hammer frame casting according to the prior art;

Figure 4 is a cross-sectional elevation view of a hammer frame casting taken along line 4-4 of Figure 1 of a hammer frame casting according to the prior art;

Figure 5 is a cross-section taken along line 5-5 of Figure 4 of the prior art hammer frame casting;

Figure 6 is a cross-section of a finished machined hammer frame taken at the same location as Section 5-5 on Figure 4 and represents a finished hammer frame according to both the present invention and the prior art;

Figure 7 is a finished machined hammer frame cross-section taken at the location of Section 4-4 for both the present invention and prior art;

Figure 8 shows a non-driven end view of the present hammer frame casting;

Figure 9 is a driven end view of the present finished hammer frame;

Figure 10 is a cross-section of the present hammer frame casting taken along line 10-10 of Figure 15 showing the hammer frame casting in the as poured position;

Figure 11 is a cross-section showing the hammer frame casting taken along line 11-11 of Figure 10; Figures 12, 13 and 14 show progressive cross-sections of the hammer frame casting as taken along lines A-A, B-B and C-C, respectively, in Figure 10; and

Figure 15 is a driven end view of the present frame casting.

The mechanism in which the hammer cage of the present invention is utilised is described in US-A-3,661,217, issued to Spencer B. Maurer, May 9, 1972.

In the prior art the hammer cage was manufactured by either machining out a solid block of steel to the general dimensions shown in the above cited patent and as generally shown in the accompanying Figures 6 and 7. It was later found advantageous to manufacture the hammer frame from a casting. The nature and shape of the casting according to the prior art is shown in Figures 1-5. In general, the casting is in the form of a rectangular box best shown in Figure 3 and generally designated by the reference numeral 100.

The hammer frame is provided with a driven end 1 and a non-driven end 2. The two ends are connected by two solid side webs 3 and 3' and two open sides generally designated 4 and 4' (see Figure 5). The solid side webs 3 and 3' are composed of two portions. The outermost portion of the web, designated 5 and

5', remains with the casting after finish machining. The innermost portion of the web, designated 6 and 6', is provided to permit supported cross drilling of the hammer cage to produce cross bores 7 and 7'. The cross bores 7 and 7' each receive a longitudinal pin 32, as shown in Figure 6 (inserted in the bottom cross bore 7' only for example).

The longitudinal pin 32 provides a tilting axis for the hammer members according to the abovementioned US-A-3,661,217. The innermost portion of the webs 6 and 6' is thereafter removed by machining to produce the cross-section best seen in Figures 6 and 7 which represent the as machined cross-section of a hammer cage according to the prior art and the present invention.

The hammer frame is further provided with a machined bore 8 on its non-driven end to receive a rotary output shaft 19 (also present US-A-3,661,217). The hammer frame is further provided with a second bore 9 for supporting one end of the rotary output shaft 19. The driven end of the hammer frame is provided with a driving spline 11 best seen in Figures 7 and 9. The driving spline 11 receives the output shaft of a pneumatic driven motor or the like which imparts rotation to the hammer frame or cage.

The present hammer frame and hammer frame casting is shown depicted in Figures 8-15. As will be described, means are provided to promote the directional solidification of the hammer frame casting to ensure particularly the integrity of the casting in the driven end as well as promote improved physical properties throughout the casting.

The present casting 110 is obtained in the following manner. The casting is poured in the vertical down position shown in Figure 10 with the molten metal being supplied through substantially enlarged sprues 22 and 22'. This provides a greater available reservoir of molten metal to the casting during the cooling process.

In addition, unnecessary volume of metal in the lower or driven end of the present casting is removed. One means of accomplishing this is shown in the embodiment represented by Figures 8-15. However, other ways may occur to one skilled in the art.

First, structurally unnecessary material has been removed from the corners 105 and the edges 107 of the casting as best seen in Figures 9 and 15. This results in an approximate 25% reduction in the driven end mass without affecting the structural integrity of the driven end.

Secondly, the solid web 103, 103' is provided with an inner surface 106 and 106' in the form of a one half frustum of a right circular cone with slightly flattened sides. The tip of the cone (removed) faces the driven end, as best seen in Figure 11. The reduction of mass towards the driven end 101 may be appreciated by viewing the end webs 103, 103' shown exaggerated progressively in Figures 12-14 corre-

sponding to cross-sections A-A, B-B and C-C, respectively on Figure 10.

It will be appreciated that the mass of the web is greater in Figure 12 than in Figure 14 thereby accomplishing a reduction of the mass of molten material solidifying from the driven end. In the prior art the cross-section of the web was constant end for end as shown in Figures 3 and 5. The reduced cross-section of the web does not affect the cross drilling performance of the support web particularly if drilling is accomplished from the driven end.

In addition to the benefits previously described the reduced cross-section of the support portion of the inner web reduces the amount of metal to be machined and therefore minimises waste.

Claims

1. A casting (110) for an impact hammer frame comprising a generally rectangular box having a driven end (101) and a non-driven end (110), and two open and two closed (103, 103') side walls; said casting being provided with a means (106, 106') for facilitating end to end boring (7) in each of said closed side walls; characterised in that said means for facilitating boring is tapered in at least one direction to provide a means for promoting casting material flow during solidification so as to accomplish directional solidification from said driven end to said non-driven end during cooling.
2. A casting according to claim 1 and further comprising means for minimising the mass of said driven end to accomplish said directional solidification.
3. A casting according to claim 2, wherein said means for minimising mass comprises a reduction of material in the exterior corners (105) of said rectangular box at said driven end (101).
4. A casting according to claim 1, 2 or 3, wherein said means for facilitating boring further comprises a one half frustum of a right circular cone (106, 106') formed on the interior of each of said closed side walls (103, 103') with the base of said cone towards said non-driven end of said casting.
5. A hammer frame manufactured from a directionally solidified casting (110), comprising a generally rectangular box having a driven end (101) and a non-driven end, and two open and two closed (103, 103') side walls; said casting being provided with a means (106, 106') for facilitating end to end boring (7) in each of said closed side walls; characterised in that said means for facilitating boring is tapered in at least one direction to

provide a means for promoting casting material flow during solidification so as to accomplish directional solidification from said driven end to said non-driven end during cooling; and said hammer frame has been manufactured by first boring through said means for facilitating boring and thereafter removing said means for facilitating boring to partly expose the bore.

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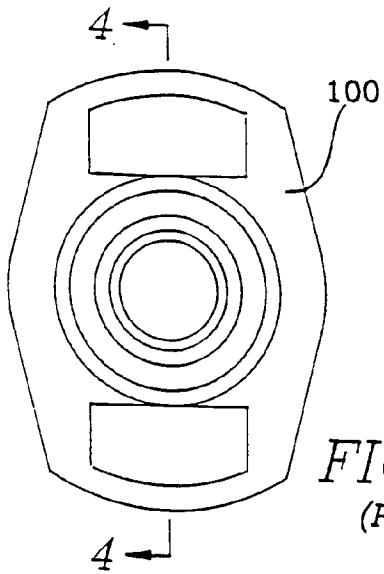


FIG. 1
(PRIOR ART)

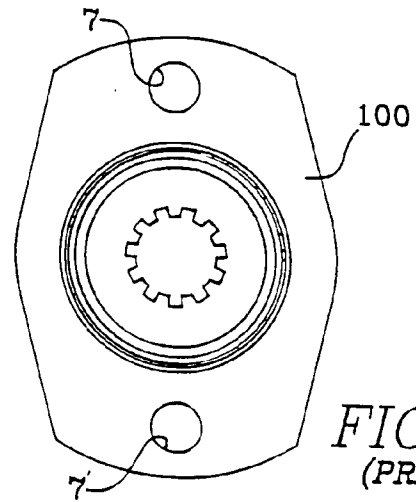


FIG. 2
(PRIOR ART)

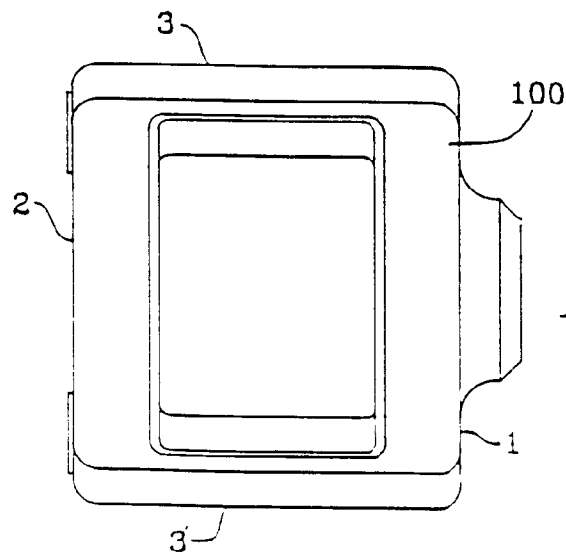


FIG. 3
(PRIOR ART)

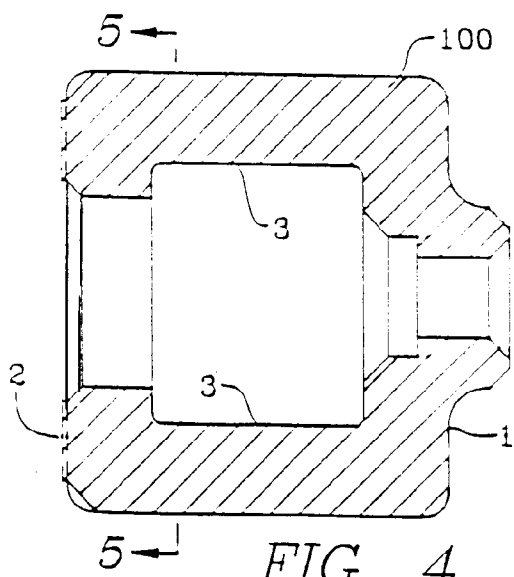


FIG. 4
(PRIOR ART)

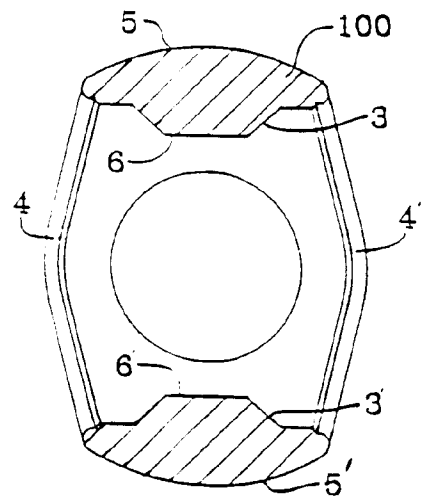


FIG. 5
(PRIOR ART)

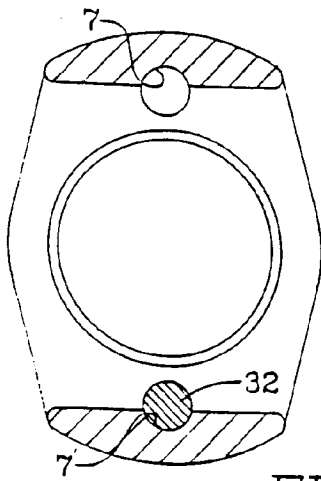


FIG. 6

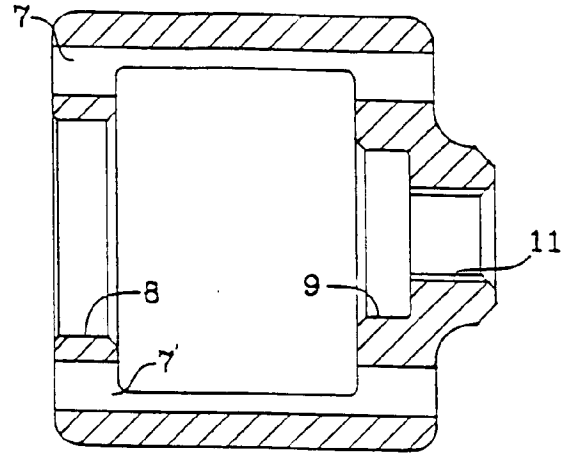


FIG. 7

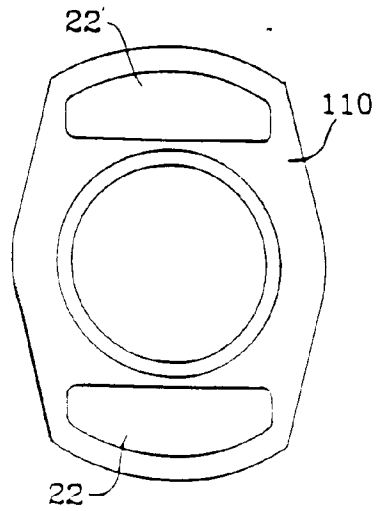


FIG. 8

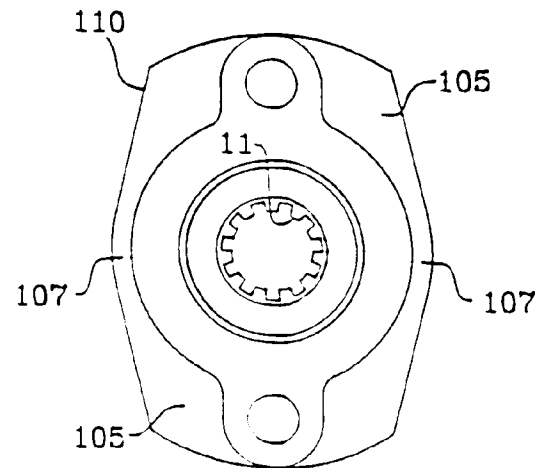


FIG. 9

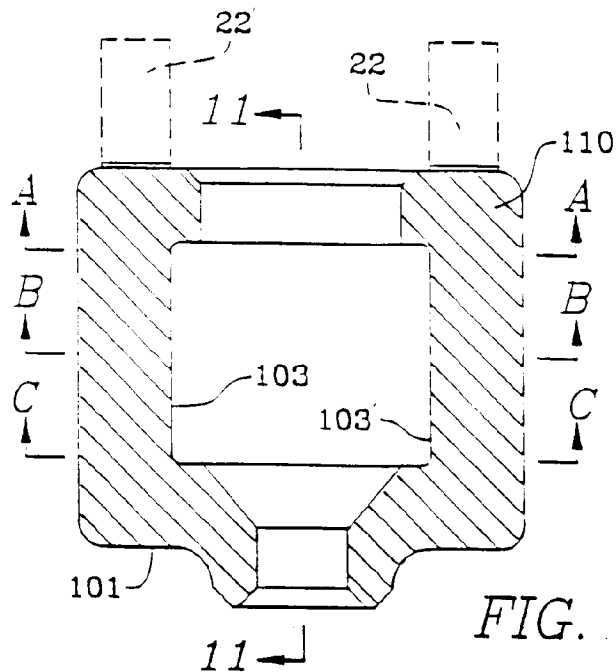


FIG. 10

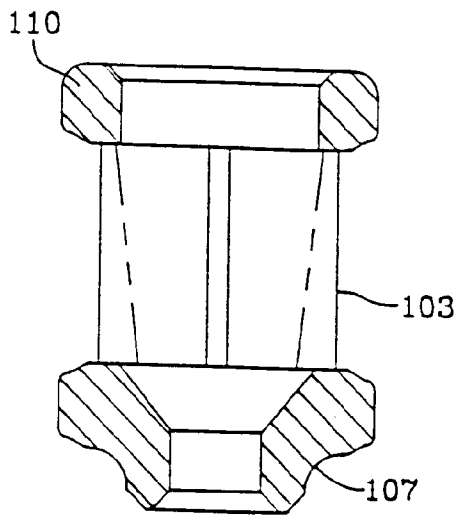


FIG. 11

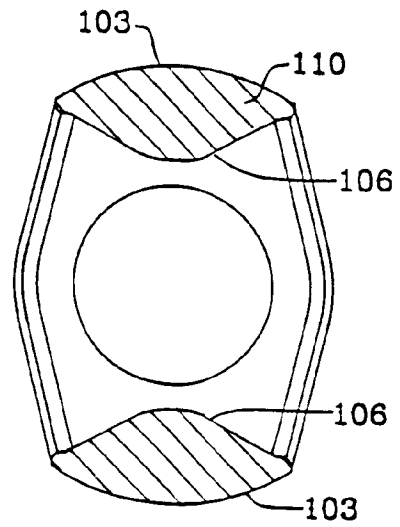


FIG. 12

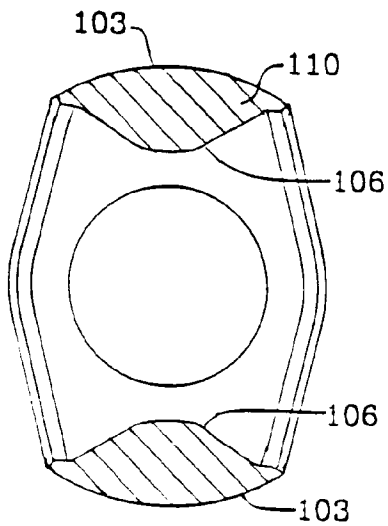


FIG. 13

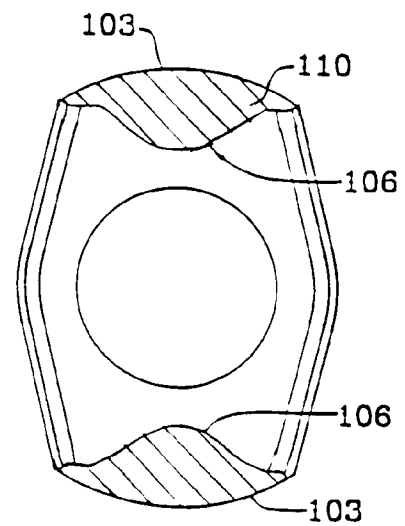


FIG. 14

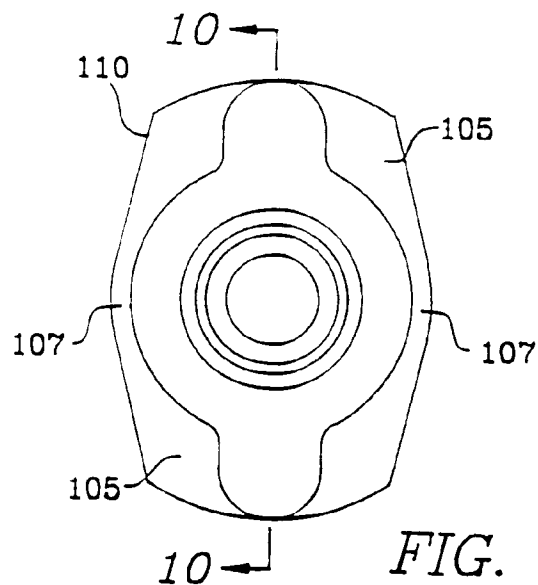


FIG. 15



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 30 2440

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D, A	US-A-3 661 217 (S.B. MAURER) ---		B25B21/02 B22D27/04
A	FONDERIE no. 12, February 1982, PARIS pages 17 - 23 M.H.KHAN 'LA SOLIDIFICATION DIRIGEE' -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B25B B22D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 06 JULY 1993	Examiner MAJERUS H.M.P.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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