

June 7, 1949.

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2,472,261

CRANKSHAFT AND METHOD OF MAKING SAME

Filed Aug. 10, 1944

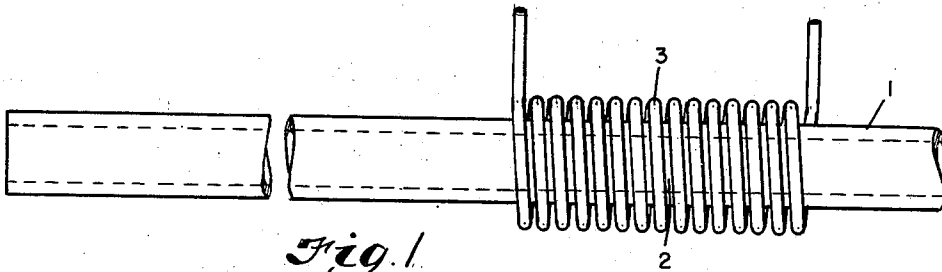


Fig. 1.

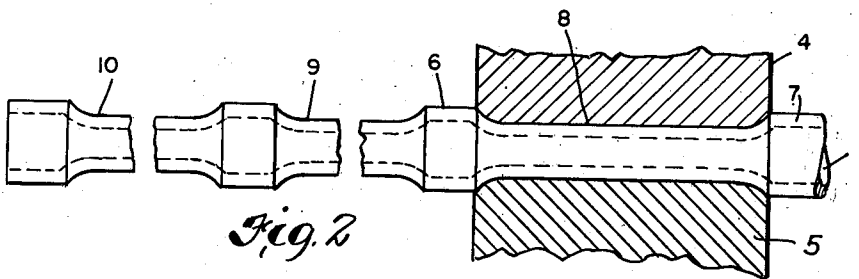


Fig. 2.

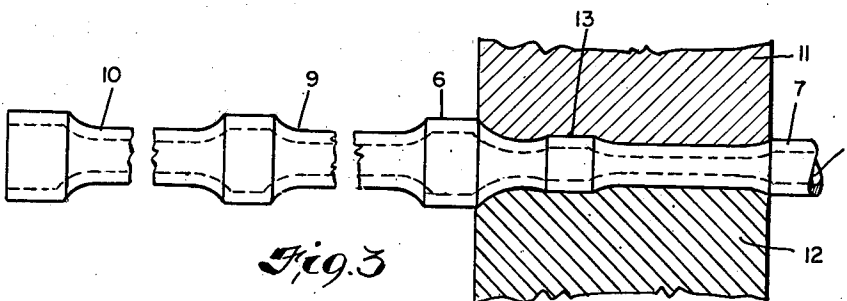


Fig. 3.

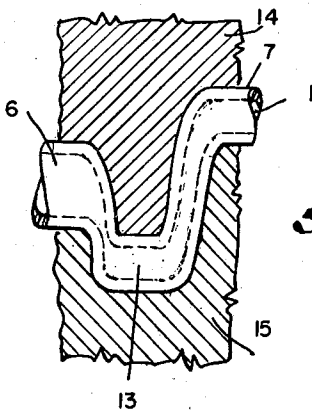


Fig. 4.

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2,472,261

CRANKSHAFT AND METHOD OF MAKING
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Application August 10, 1944, Serial No. 548,833

1 Claim. (Cl. 29—6)

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This invention relates as indicated to crankshafts and method of making the same and more particularly to a crankshaft which is formed of a tubular body whereby the ultimate structure may be produced much more economically than the forgings which are used at the present time.

It is a further object of my invention to provide a structure which, because of the tubular nature of the blank from which it is made, has much less weight than the heavier solid structures of the prior art.

It is a further and more particular object of the invention to provide a structure which because of its tubular nature will facilitate the circulation therethrough of lubricants, cooling media, and the like.

It is still another object of my invention to provide a method of making such a crankshaft which is not only economical but which will also result in a finished structure having the proper characteristics.

Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claim, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing—

Fig. 1 is a broken side elevation of a blank from which my improved crankshaft may be made, showing mounted thereon induction heating coil as per one of the steps in the improved process also forming a part of my invention;

Fig. 2 is a view showing an intermediate stage in the operation of forming the crankshaft and wherein the first series of reduced areas are formed between certain of the bearing areas;

Fig. 3 is a view showing a more advanced stage in the manufacture of the crankshaft; and

Fig. 4 is a view of a portion of the crankshaft blank shown in the previous figures and illustrating the manner in which one of the radially displaced crank arms on the shaft may be formed.

Referring now more specifically to the drawing and more especially to Fig. 1, as the first step in the new process of forming my improved crankshaft, I provide a cylindrical blank generally indicated at 1 which is preferably a seamless tube

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not only the necessary workability for the ensuing steps in the process, but also the necessary strength and rigidity in the final product. There are many alloys available for this purpose and since the composition of the tube forms no part of the present invention, it is believed unnecessary to more specifically define the same.

As the first step in my improved process, I locally heat an area 2 of the blank 1 and this can be accomplished by any suitable means such as for example by means of an induction heating coil generally indicated at 3 which in effect comprises the primary of a transformer with the portion of the blank 1 therein comprising a one-turn secondary of such transformer.

The area 2 is thus heated sufficiently so as to render the same readily workable as for example between a pair of rolls 4 and 5 which are peripherally contoured as illustrated in Fig. 2 and which are capable of reducing the diameter of the blank 1 in the heated area. The width or axial extent of the rolls 4 and 5 will depend upon the dimension of the finished crankshaft under construction, it being observed that the areas 6 and 7 which lie immediately outside of the area engaged by the rolls 4 and 5 will, in the final form, constitute the main bearing areas of the crankshaft.

A series of reduced areas 8 and 9 and 10 are thus formed in axially spaced relation on the blank 1, leaving therebetween the said main bearing areas.

The local areas 8, 9, and 10, after being thus formed, as illustrated in Fig. 2, are again heated to a workable temperature by some suitable means such as induction heating and are thereafter again engaged by a second pair of rolls 11 and 12 which have the function of further reducing the major portion of the diameter of such areas 8, 9, and 10 by leaving intermediately thereof a series of axially spaced slightly enlarged areas such as 13, which in the final fabricated form of the crankshaft will constitute the connecting rod bearing areas.

After the blank is formed in the manner illustrated in Fig. 3, the entire axial extent of the blank shown embraced by the rolls 11 and 12 in Fig. 3 is again heated to a suitable working temperature, whereupon a pair of dies 14 and 15 are brought into engagement with such heated area to radially displace from the main axis of the crankshaft, i. e. the axis of the main bearing areas, the connecting rod bearing area 13. In this last forming operation, it will be observed, of course, that the main bearing areas 6 and 7 are brought axially

closer together, and in the design of the rollers employed in the previous steps of the process due allowance must be made for such axial movement.

By the die forming operations just described, I am able to produce a crankshaft blank which is substantially the size and shape of the desired end product. After the crankshaft has been formed by rolling and forging or die working in the manner just described, the several axially spaced bearing areas thereon are then ground to approximately the desired finished diameter and the bearing surfaces then completed by means of a lapping operation as in a conventional crankshaft lapping machine, of which there are a number available on the market.

It will be observed that by the exercise of the proper care as by way of a careful control over the extent to which the blank is heated and the degree and manner in which it is deformed in the various forming steps, it is possible to end up with a structure having a continuous passage there-through. Such continuous passage makes possible the circulation through the crankshaft of a suitable lubricant and/or cooling medium, as for example lubricating oil under pressure. When lubricating oil under pressure is circulated through the crankshaft, then radial openings through the wall of the finished structure in the bearing areas will provide means whereby such bearing areas are always supplied with adequate lubricating oils. On the other hand, in certain types of engines, it is possible to employ a cooling medium such as a flow of air through the crankshaft for the purpose of cooling the same during use.

The improved crankshaft of my invention will be found to have not only the necessary strength and rigidity, but will also be capable of fabrication much more economically than the solid structures now being employed because it is much easier to thus shape a tubular member than a solid structure.

Forming the crankshaft of a seamless tube in the manner above explained in carrying out my improved method will result in a structure in which there is a substantially continuous grain

flow throughout the entire length of the shaft, thus contributing to the necessary strength and rigidity of the shaft.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in the following claim or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

The method of forming a crankshaft such as those used in internal combustion engines which comprises providing a cylindrical blank of diameter corresponding substantially with the diameter of the main bearings of the final form of crankshaft, heating a portion of the length of the blank to a workable state, rolling and forming in such heated portion an elongated reduced section of uniform reduced diameter corresponding substantially with the diameter of the connecting rod bearings of the final form of crankshaft, further rolling said elongated reduced portions at spaced points to leave intact an intermediate connecting rod bearing of a size as secured by said first rolling and to form sections of further reduced size corresponding substantially with the size of the crank arms of the final form of crankshaft, and relatively radially displacing said main and connecting rod bearing sections into the relative positions they are to occupy in the final form of crankshaft.

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