March 10, 1959  D. J. WULPI  2,876,528
TOOL FOR COLD ROLLING CRANKSHAFT FILLETS
Filed Feb. 17, 1956

[Diagram of tool for cold rolling crankshaft fillets]

INVENTOR.
Donald J. Wulpi

BY  Ruelle Rippel
City:
TOOL FOR COLD ROLLING CRANKSHAFT FILLETS

Donald J. Wulpi, Downers Grove, Ill., assignor to International Harvester Company, a corporation of New Jersey

Application February 17, 1956, Serial No. 566,177

1 Claim. (Cl. 29—90)

This invention relates to an improved device for cold rolling of crankshaft fillets and the like.

In the design of crankshafts or similar articles, it is desirable to provide annular fillets adjacent the ends of the journal portions where they are integrally connected to the counterweights of the crankshaft. The fillets of course are provided to reduce the possibilities of cracking or breaking of the metal during stresses encountered in normal operation. In the art of metallurgy it has also been determined that breakage can be greatly reduced by subjecting the fillets to cold working thus in turn relieving to a great extent harmful residual stresses and in turn imparting to the fillet the more desirable metallurgical properties normally resulting from residual compressive stresses at highly stressed places on the crankshaft. It is a principal object of this invention to provide an improved tool which is readily adapted for the cold rolling of crankshaft fillets and the like.

Still another object is to provide an improved fillet rolling tool adapted to be quickly attached and supported by a crankshaft during manufacturing operation wherein the crankshaft may be rotated by any suitable rotating machine such as a lathe or similar device.

A still further object is to provide an improved crankshaft fillet rolling device adapted to exert a maximum pressure at any desired angle against the fillets which are positioned adjacent the ends of a journal portion where the journal portion meets the cheeks or counterweights of the crankshaft.

A still further object is to provide an improved fillet rolling tool wherein laterally disposed fillets may be placed under compressive stresses by means of rollers which are self-adjusting and self-centering thereby providing the application of maximum pressures.

A still further object is to provide an improved self-contained fillet rolling tool for crankshafts, the tool being adapted to be supported on the crankshaft thus eliminating the possibility of bending loads such as are encountered in the use of tools which are rigidly supported apart from the crankshaft per se.

A still further object is to provide a self-contained fillet rolling tool having a biasing means adapted to be preloaded to maintain a steady and consistent compression force against the fillets which are being rolled.

A still further object is to provide an improved fillet rolling tool for crankshafts or the like, the said tool being readily adapted for rolling crankshaft fillets of different sizes.

These and other objects will become more readily apparent from a reading of the specification in connection with the accompanying sheet of drawing.

In the drawing:

Figure 1 is a plan view of a conventional crankshaft supported on the rotating elements of a conventional machine tool, such as a lathe, etc.;

Figure 2 is an enlarged side elevation view of a tool for cold rolling of crankshaft fillets showing the tool attached to a section of a crankshaft; and

Figure 3 is a plan view of a portion of a crankshaft showing a fillet rolling tool in an operating position.

Referring now particularly to Figure 1, a crankshaft is generally designated by the reference character 10. The type of crankshaft disclosed is conventional in internal combustion engines and comprises centrally disposed bearing portions 11 and longitudinally spaced and offset connecting rod journal portions 12. Crankshafts of this type are usually made by casting and integral counterweights or cheek portions 13 are joined to the journal portions 12 and include integral annular fillets 12. The cross-sectional dimension transversely through the axis of each journal portion is of course considerably less than the cross-sectional dimension of the cheek or counterweight 13. The reasons for the eccentric disposition of the journal portions 12 relative to the bearing portions 11 is of course obvious in the design of crankshafts and need not be further described. The crankshaft 10 further includes oppositely disposed connecting portions 14 and 15. As best indicated in Figure 1, the crankshaft 10 is supported for rotation by means of a chuck 16 and a cutter or spindle 17 the latter said elements forming part of a conventional lathe or similar machine tool.

Referring now to Figures 2 and 3, a fillet rolling tool is generally designated by the reference character 18. The tool 18 comprises a U-shaped frame 19 having oppositely disposed end portions 20 and 21. The end portion 21 includes upper support rollers 22 journaling on a shaft 23 extending through the frame 19. Back-up rollers 24 are disposed on opposite sides of the end portion 21 and are suitably journaled on a shaft 25 extending through the frame 19.

A fillet compressing tool element 26 is supported on the frame 19, the said element 26 including longitudinally spaced compression members 27 and 28. The compression members 27 and 28 are integrally connected by means of a biasing member or U-shaped spring 29.

The compression member 27 has at one end a yoke 30 to which hinge brackets 31 and 32 are hingedly connected by means of a hinge pin 33. Compression rollers 34 in turn are freely journaled on the brackets 31 and 32 by means of shafts 33.'

The compression member 28 is suitably threaded as indicated, at one end, by the reference character 35. The threaded end 35 is threaded into a threaded sleeve 36 which is suitably connected to a rotateable shaft 37 journaled in a bore 38 of the end portion 20. Oppositely disposed collar 39 maintains the shaft 37 in the position indicated. A hand wheel 40 is suitably connected to the shaft 37.

A pair of tension levers 41, as best shown in Figure 3 are provided with handle portions 42. The tension levers 41 are rigidly secured to a shaft 43 extending through and journaled on the compression member 28. Each tension lever 41 has suitably connected thereto a cable 44 the cable 44 being connected to transversely spaced ears 45 provided on the compression member 27. A stop 46 is provided on the end portion 28, the said stop being adapted to maintain the tension lever 41 in an overcenter or pretensioned position as indicated in the dotted line disclosure of Figure 2. A U-shaped strap 47 is suitably supported on the frame 19, the said strap having portions thereof engaging the sides of the compression member 20 to restrain the same against turning movement. As best shown in Figure 2, the end portion 20 of the frame 19 is adapted to rest upon a lathe bed 48 or similar support of the type of machine tool which is utilized.

In the operation the crankshaft is suitably supported
for rotation on a lathe chuck 16 and a center 17. The fillet rolling device 19 is then positioned in the manner indicated in Figures 1 and 2 with the rollers 22 and 24 in the engaging position indicated relative to the journal 12. The end portion 20 is suitably resting upon the lathe bed or platform 48. The tension levers 41 are then moved in a clockwise direction whereupon the cables 44 are placed under tension and draw the compression member 27 in a direction toward the compression member 28 whereupon the U-shaped spring 29 is preloaded or cocked. By rotating the tension levers 41 to an over-center position against the stop 46 the spring 29 is suitably preloaded in this position. The operator then rotates the hand wheel 40 whereupon the tool 26 is moved toward the journal 12. The rollers 34 freely roll 35 on the brackets 31 and 32 and the brackets 31 and 32 are freely hinged on the yoke 30. Thus as the tool 26 is moved toward the journal 12 the rollers 34 are self-centering and suitably engage the annular fillets 12' at the desired angle for properly compressing the said fillets.

Rotation of the chuck 16 now effectuates turning of the crankshaft 10 and the tension levers 41 are moved in a counterclockwise direction thereby releasing the spring 29. The spring 29 now exerts a pressure biasing the compression member 27 against the rollers 34 to exert the desired pressure against the annular fillets 12'.

The compressive forces of course can be lessened or increased by simply changing the point of attachment of the cables 44 on the arm 41. As indicated in Figure 2, by the reference character 41' the ends of the cables are fastened by a tack weld, though various other adjustable fastening means may be utilized. Thus the desired amount of compressive force can be varied depending upon the type of fillets to be rolled. The strap 47 prevents turning movement of the tool 26 during rotation of the hand wheel 40. Longitudinal adjustment of the tool 26 relative to the frame 19 of course can be achieved by various other designs. For instance a square shaft 37 may be utilized in connection with the bore 38 to prevent turning movement now prevented by the strap 47. In such a design other provisions for longitudinal adjustment can readily be accomplished.

As the crankshaft 10 is rotated, eccentric disposition of the journal of course causes reciprocation of the fillet rolling device 18 in the same manner as if a connecting rod were attached to the crankshaft. Thus as the crankshaft journal member 12 rotates, the end portion 20 of the frame 19 which is supported on the bed 48 reciprocates with respect to the said bed.

It is obvious of course that all of the fillets 12' of the crankshaft may be rolled simultaneously by the utilization of a plurality of these fillet rolling devices. Furthermore, changes in size in the journal portion can be accommodated by different size rollers and brackets.

The free movement of the brackets 31 and 32 relative to the yoke 30 permits the ready self-centering of the rolling tool. The unit is completely self-contained and is supported substantially on the crankshaft itself thus eliminating the dangers of distortion or bending which might be occasioned by the rigid support of a tool on any portion of a machine extraneous of the crankshaft itself. Thus distortions of the crankshaft are also prevented. Ready adjustment of the compression forces is possible by the utilization of the simple tension levers indicated.

Thus it is apparent that the objects of the invention have been fully achieved and it must be realized that changes and modifications may be made without departing from the spirit of the invention as disclosed or the scope thereof as defined in the appended claim.

What is claimed is:

A device adapted for compressing laterally spaced annular metal fillets of a journal member connected to and disposed between coaxial members having a sectional dimension transversely through their axes greater than the transverse sectional dimension of the journal member, comprising: a generally U-shaped frame having first and second opposite end portions, first and second rotatable bearing members connected to said first end portions and adapted to engage said journal member at circumferentially spaced portions thereof, a fillet compressing tool on said frame, said tool comprising first and second longitudinally spaced compression members, a U-shaped spring member connecting said first and second compression members, brackets hingedly connected to said first compression member, fillet rollers rotatably connected to said brackets, rotatable adjustable means connected to the second end portion of said frame and to said second compression member whereby said tool may be reciprocated relative to the journal member, spring tensioning means for pre-loading said spring including a tension member connected to said first compression member, and a movable locking member connected to said tension member and to said second compression member for locking said spring in a pre-loaded position, said rollers being movable into relative rolling engagement with the fillets, and said pre-loaded spring being releasable for urging said rollers into compressive engagement with said fillets during rotation of said journal member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,397,515 Jackman September 5, 1944
2,437,641 Hein March 9, 1948
2,515,469 Power July 18, 1950
2,595,668 Getty May 6, 1952