Sept. 21, 1954 L. W. BEDKER 2,689,493

APPARATUS FOR ROLLING GROOVES

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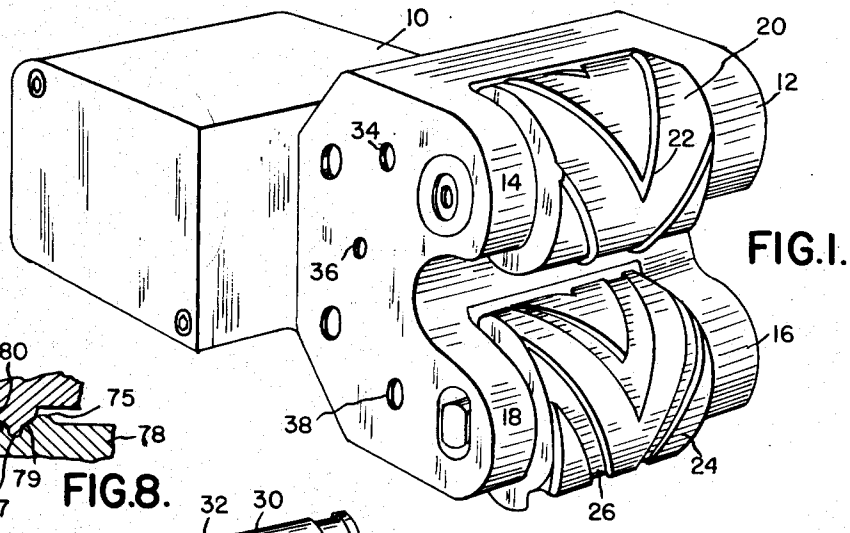


FIG.1.

FIG.8.

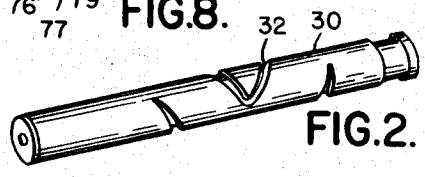
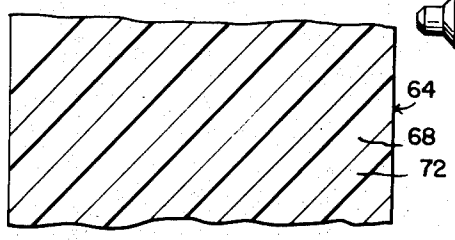


FIG.2.

FIG.7.



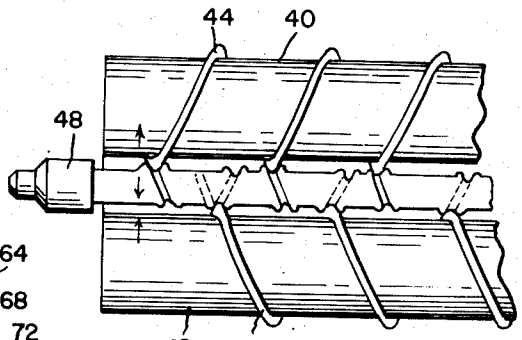


FIG.3.

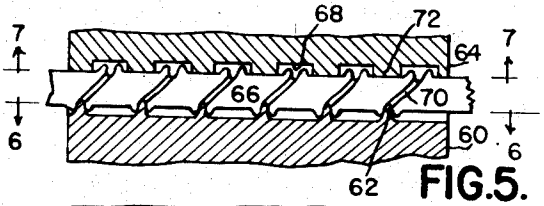


FIG.5.

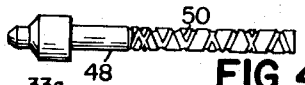


FIG.4.

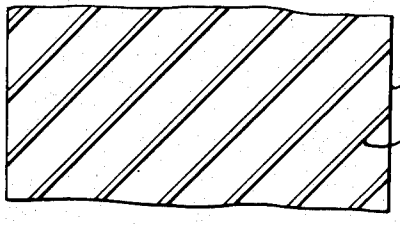


FIG.6.

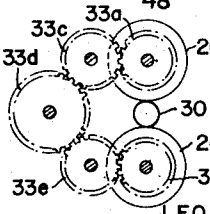


FIG.9.

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APPARATUS FOR ROLLING GROOVES

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8 Claims. (Cl. 80—24)

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The present invention relates to apparatus for rolling grooves and more particularly for rolling oil grooves in machine parts.

In accordance with the present invention oil grooves are rolled in machine parts such as shafts or the like, by machines of the type employed for rolling threads, modified by the substitution of groove rolling fixtures and supporting members of the type disclosed herein. The rolling in of the oil grooves results in the formation of displaced metal along the sides of the grooves and this in turn requires a subsequent grinding or finishing operation to bring the member back to its original form. According to one aspect of the invention the oil grooves are so formed that the grinding operation takes place without the formation of burrs at the edges of the oil grooves.

It is an object of the present invention to provide means for rolling oil grooves in machine parts.

It is a further object of the present invention to provide apparatus including a grooving roll in combination with means operating to support the work piece opposite to the grooving roll.

More specifically, it is an object of the present invention to provide a ribbed grooving roll in combination with an opposed roll having recesses adapted to move into registry with the grooves formed on the work piece, and to support the work piece against the radial thrust imposed by the grooving roll.

It is a feature of the present invention to provide opposed grooving rolls adapted to roll independently and in some cases, crossing oil grooves.

While the invention has been described in detail, particularly with reference to grooving rolls, the invention may also be practiced with flat grooving dies which have a rolling motion relative to a cylindrical work piece.

Other objects and features of the invention will become apparent as the description proceeds, especially when considered in conjunction with the accompanying drawings, wherein:

Figure 1 is a perspective view of a fixture illustrated as supporting a grooving roll and opposed recessed back-up roll.

Figure 2 is a perspective view of the part rolled by the fixture shown in Figure 1.

Figure 3 is a fragmentary elevational view showing a pair of opposed grooving rolls of opposite hand performing the grooving operation on a work piece.

Figure 4 is an elevational view of a work piece produced by the apparatus illustrated in Figure 3.

Figure 5 is a transverse section through a groove rolling device employing a flat ribbed

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grooving die and a corresponding flat recessed back-up roll.

Figure 6 is a plan view of the grooving die looking in the direction of the arrow 6—6, Figure 5.

Figure 7 is a fragmentary plan view of the recessed back-up die shown in Figure 5 looking in the direction of the arrow 7—7, Figure 5.

Figure 8 is a fragmentary section through a grooving rib illustrating the manner of displacing metal from the oil groove in the work piece.

Figure 9 is a diagrammatic view showing the means for connecting the rolls.

Referring now to the drawings, there is illustrated in Figure 1 a fixture 10 comprising a first pair of forwardly extending ears 12 and 14, and a second pair of forwardly extending ears 16 and 18, the pairs of ears being spaced apart as illustrated. Mounted between the ears 12 and 14 is a grooving roll 20 having upstanding grooving ribs 22 formed thereon. Intermediate the ears 16 and 18 is a recessed back-up roll 24 having recesses 26 therein adapted to register with and receive material displaced from the oil grooves formed in a work piece. The work piece produced by the structure illustrated in Figure 1 is shown in perspective at 30 in Figure 2 and it will be observed that the oil groove 32 formed therein in this instance, extends with opposite hand from a central portion toward either end thereof. Obviously, an oil groove of continuous helical form could be produced by the appropriate formation of the rib or ribs 22 on the grooving roll.

In operation, a rotating work piece which for example may be located in the work supporting head of an automatic screw machine, is positively rotated and is moved tangentially into the space between the rolls 20 and 24. Rotation of the work piece 30 causes rotation of the rolls 20 and 24. Moreover, the rolls 20 and 24 are geared together for timed rotation. In Figure 9 the means for gearing the rolls 20 and 24 together are illustrated as comprising a gear 33*a* secured to the shaft supporting the roll 20, a gear 33*b* secured to the shaft supporting the roll 24, and intermediate gears 33*c*, 33*d*, and 33*e*. The gears 33*c*, 33*d*, and 33*e* are supported on shafts extending in openings in the frame 10 designated respectively as 34, 36 and 38. It will be observed that the grooves 26 are of substantial width as is necessary to accommodate the material displaced laterally from the oil groove 32. Moreover, additional width in the groove is desirable since such an arrangement does not require too exact registration between the parts.

Referring now to Figures 3 and 4 there is illustrated a pair of opposed groove rolls 40 and 42.

As illustrated, the groove 40 has a left hand helical grooving rib 44 formed thereon. The roll 42 has a right hand grooving rib 46 formed thereon. It will be understood that the rolls 40 and 42 are geared together for simultaneous rotation by gears similar to those described in connection with Figure 1. Again, a rotating work piece 48 is introduced tangentially between the rolls 40 and 42, thus imparting rotation to the rolls. It will be observed that the ribs 44 and 46 are of substantially greater height than the depth of groove to be formed in the finished work piece, thus allowing clearance for the metal displaced laterally from the oil grooves. In the modification illustrated in Figures 3 and 4 the work piece 48 has crossing oil groves 50 formed therein but the same method could obviously be employed to produce two independent non-crossing helical grooves of the same hand.

Referring now to Figures 5–7 the same invention may be practiced employing a flat grooving die 60. Such a die is provided with diagonally disposed grooving ribs 62. A back-up plate 64 is provided to engage the side of a work piece 66 opposite to the side engaged by the grooving die 60. The back-up plate has diagonally extending recesses or channels 68 of a size and position to register with and receive the oil grooves 70 formed by the ribs 62 and also of sufficient width to provide space for the metal displaced laterally from the oil groove. Intermediate the diagonally extending recesses or channels, the plate 64 is provided with flat upstanding supporting lands 72 which engage portions of the work piece 66 intermediate the oil groove 70.

In use the die 60 and the back-up plate 64 contact the work piece 66 at diametrically opposite portions thereof and are moved tangentially in opposite directions with respect to the rotating work piece 66. The pressure applied to the work piece by the grooving ribs 62 is taken up by the flat supporting lands 72 of the plate 64.

As previously stated, the formation of the oil grooves in the work piece results in lateral displacement of metal out of the oil grooves into upstanding beads such as illustrated at 75 in Figure 8. In order to form the beads 75 in a manner which prevents the formation of burrs at the edges of the oil groove of the finished product, the grooving ribs in any of the preceding arrangements may be and preferably are formed as illustrated at 76 in Figure 8. It will be observed that the rib includes a narrow portion 77 adapted to enter below the original cylindrical surface of the work piece 78. The rib in the vicinity of the projection of the original cylindrical surface of the work piece is reversely curved as indicated at 79 and is thereafter shaped to provide the shoulders 80.

After the oil groove has been rolled into the work piece the beads 75 are removed by grinding. Since the ribs 76 are shaped to provide a surface which merges more or less gradually into the original cylindrical surface of the work piece, grinding away the beads 75 produces a smooth surface at the corners or edges of the oil groove thus produced.

The drawings and the foregoing specification constitute a description of the improved apparatus for rolling grooves in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. Apparatus for rolling a helical oil groove in a cylindrical work piece comprising a grooving member having a grooving rib thereon, a back-up member engaging the opposite side of said work piece from said grooving member and having rolling contact therewith, said back-up member having a wide groove to accommodate the oil groove formed by said rib and smooth portions adjacent said wide groove therein to engage the original cylindrical surface of the work piece at the sides of the oil groove being rolled therein.

2. Apparatus for rolling a helical oil groove in a cylindrical work piece comprising a holder, opposed rolls in said holder, said rolls comprising a grooving roll having a helical grooving rib thereon and a backing roll having a wide helical groove for accommodating the oil groove and material displaced therefrom on the work piece.

3. An oil groove forming roll having a helical rib thereon, said rib having a top portion corresponding in cross-section to the desired section of oil groove, and a wider base portion, said portions being connected by concave filets designed to shape the extruded metal into rounded masses capable of being ground away without producing burrs at the edges of the oil grooves.

4. An oil groove forming roll having a helical rib thereon, said rib having a top portion corresponding in cross-section to the desired section of oil groove, and a wider base portion, said portion being connected by concave filets which are substantially tangent to the original cylindrical surface of the work piece so that the extruded metal at the sides of the oil groove may be ground away without producing burrs at the edges of the oil grooves.

5. Apparatus for rolling a helical oil groove in a cylindrical work piece comprising a grooving member having an inclined grooving rib thereon of greater height than the depth of oil groove to be rolled to provide clearance for material rolled out of the groove on the work piece, a back-up member engageable with the opposite side of the work piece from said grooving member, and having relative rolling contact therewith, said back-up member having a smooth surface engageable with the cylindrical surface of the work piece and having a groove provided therein substantially wider than said grooving rib disposed to accommodate the groove formed in the work piece to avoid pressing down material rolled up out of the groove formed in the work piece by said grooving rib.

6. Apparatus as defined in claim 5 in which one of said members is generally in the form of a flat plate.

7. Apparatus as defined in claim 5 in which both of said members are generally in the form of flat plates.

8. Apparatus as defined in claim 5 in which both of said members are generally in the form of cylindrical rolls.

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