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METHOD OF GRINDING IRREGULAR SHAFTS

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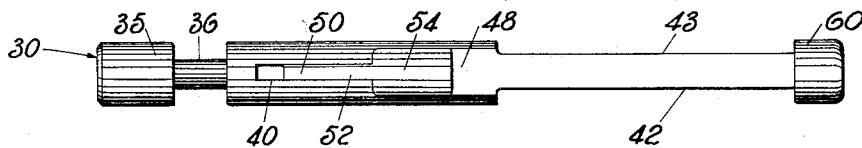
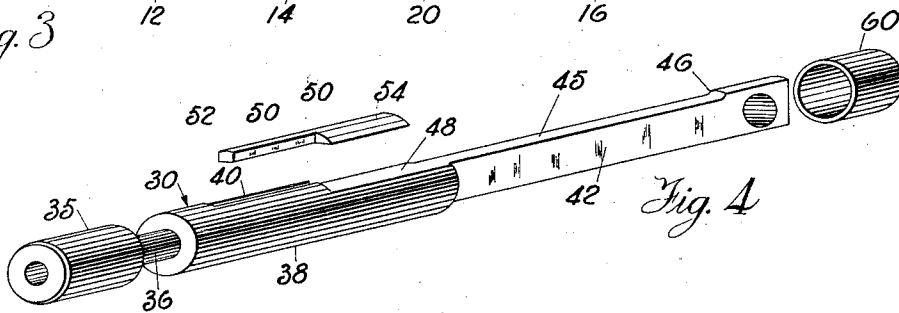
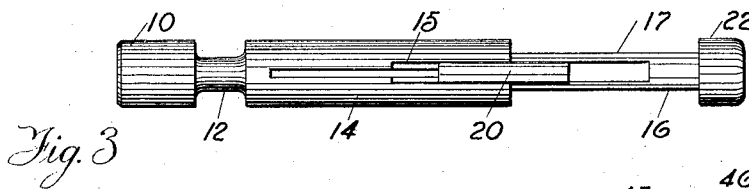
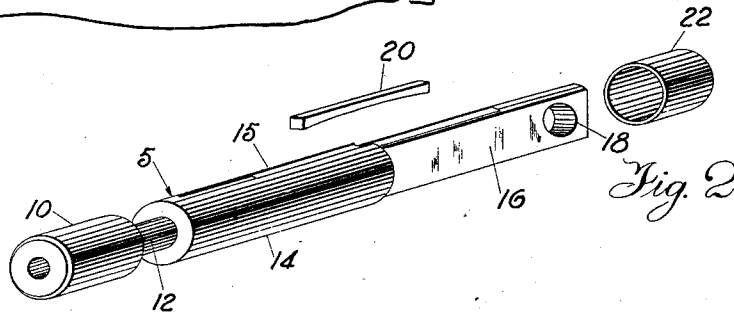
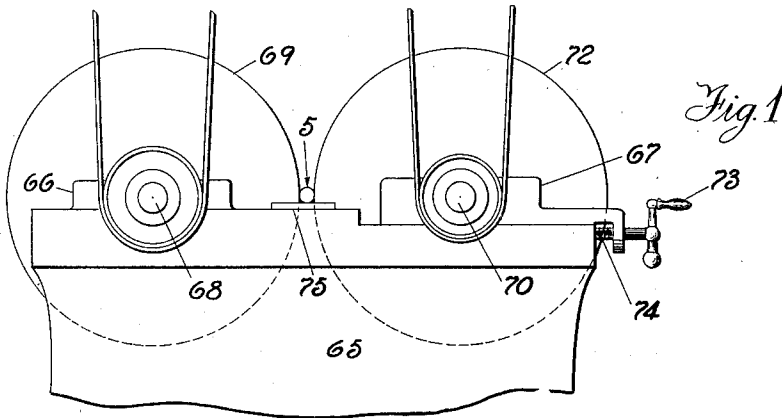


Fig. 5

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## UNITED STATES PATENT OFFICE

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## METHOD OF GRINDING IRREGULAR SHAFTS

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This invention relates to a method of grinding irregular shafts and particularly to a method of grinding cylindrical shafts which have flattened portions or key-ways formed therein, and has for its principal object the provision of a method for smoothly and accurately grinding cylindrical shafts having flattened portions or key-ways formed therein.

10 A further object is the provision of a method for rapidly and economically grinding a shaft as described above.

Other objects and advantages will appear as the description proceeds.

15 The drawings illustrate two examples of such irregular shafts as are particularly adaptable to the use of the method of this invention, and also illustrate the method by which irregular shafts may be quickly, 20 smoothly and accurately ground. The drawings, however, are not to be considered as limiting the invention, the scope of which is entirely commensurate with the scope of the co-pending claims.

25 In the drawings:

Figure 1 illustrates the method of grinding cylinder shafts in a centerless grinder.

Figure 2 is a perspective view of an irregular shaft, a key formed to fit in a slot 30 in the shaft, and a cap formed to fit over one end of the shaft.

Figure 3 is a plan view of the shaft, key and cap illustrated in Figure 2.

Figure 4 is a perspective view of a slightly 35 different form of irregular shaft and shows a key formed to fit in the slot in the shaft, and a cap adapted to cover the end of the shaft.

Figure 5 is a plan view of the shaft, key and cap illustrated in Figure 4.

40 Referring to the drawings in detail, Figures 2 and 3 illustrate an irregular shaft generally indicated at 5, having a cylindrical end portion 10, a reduced portion 12 and an intermediate cylindrical portion 14 having 45 formed therein a longitudinal groove or key-way 15. Beyond the intermediate cylindrical portion, the shaft is provided with flat surfaces 16 and 17 and a transverse aperture 18 through the end thereof opposite the cylindrical portion 10.

From an inspection of this illustration, it will be observed that a shaft of this character would be impossible to grind by ordinary methods as the key-way breaks into the cylindrical surface and would cause the grinding wheels to rotate unevenly against the surface of the shaft, thereby producing a shaft having a surface far from accurately cylindrical. Also the flattened surfaces 16 and 17 make it impossible for the shaft to properly rotate on the holding mechanism of a centerless grinder. In order to overcome this difficulty and make it possible to grind the shaft in an ordinary commercial grinder, a key 20 is provided of such dimensions as to fit closely and accurately within the slot 15 and form a continuation of the cylindrical surface of the shaft over the slot. This key is made of material of the same hardness as the shaft and is slightly bent 70 longitudinally so that it may be driven into the key-way 15 and wedged therein against accidental removal during the grinding process.

For the flattened end of the shaft, there 75 is provided a cap 22 which consists simply of a cylindrical cup which may be machined out of tubing or stamped out of sheet metal. This cup 22 has such an internal diameter and such a thickness that it will fit securely upon the 80 flattened end of the shaft and have an outer surface of substantially the same diameter as the outer surface of the cylinder portions 10 and 14.

When the key 20 has been inserted in the key-way 15 and the cap 22 placed upon the end of the shaft, the shaft may then be inserted in a centerless grinder such as is illustrated in Figure 1, and will progress through the grinder in the usual manner, all 90 surfaces being smoothly and accurately ground to the desired dimensions.

Figures 4 and 5 illustrate an irregular shaft somewhat similar to that illustrated in Figures 2 and 3 but differing in details sufficiently to require a modification of the invention as applied to the shaft illustrated in Figures 2 and 3.

The shaft illustrated in Figures 4 and 5 and generally indicated at 30 has a cylindrical 100

cal end portion 35, a notch or groove portion 36, and an intermediate cylindrical portion 38 provided with a groove or key-way 40. Beyond the cylindrical portion 38, the shaft is provided with two flattened surfaces 42 and 43 and an additional flattened surface 45 at right angles to the surfaces 42 and 43 and extending from a point 46 adjacent the end of the shaft opposite the cylindrical portion 35 into the cylindrical portion 38 as indicated at 48.

In order to round out the cylindrical portion 38, I have provided a key 50 which has a narrow portion 52 adapted to fit into the key-way 40 and a wider portion 54 adapted to cover the portion 48 of the flattened surface 45 and having a partly cylindrical upper surface adapted to form a continuation of the surface of the cylindrical portion 38. In this instance there is also provided a cup shaped cylindrical cap 60 adapted to fit upon the flattened end of the shaft 30 and provide a surface having substantially the same dimensions as the surface of the portions 35 and 38.

The portion 52 of the key 50 is formed to fit tightly into the key-way 40 and is slightly bent longitudinally so that it will wedge firmly in the key-way. When the key 50 and the cap 60 have been inserted on the shaft 30, the shaft may then be inserted in a centerless grinder as illustrated in Figure 1 and will progress through the grinder in the usual manner.

Referring to Figure 1, it will be observed that the grinder used in this operation is of the centerless type and comprises a frame 65, a fixed journal bearing 66 and a slidable journal bearing 67. Mounted on a shaft 68 which rotates in the fixed journal bearing 66 is a grinding wheel 69, and mounted on a shaft 70 which rotates in the slidable journal bearing 67 is a similar grinding wheel 72. The slidable journal bearing 67 is manually adjusted by means of a crank 73 connected with a screw 74.

A bed plate or block 75 is provided at each side of the grinding wheels 69 and 72. The shaft 5 to be ground is placed upon the block 75 and forced through between the rapidly rotating grinding wheels 69 and 72. During this operation, the distance between the two grinding wheels 69 and 72 is adjusted by means of the crank 73 until the shaft is ground to the exact dimensions required.

Owing to the fact that the shaft 5 rotates as it progresses between the grinding wheels, it will be seen that it is necessary that the shaft should have a cylindrical surface at both ends thereof so that the axis of the shaft will remain parallel to the axis of rotation of the grinding wheels, and it is also apparent that the cylindrical surface being ground must be substantially continuous, as any breaks in the continuity of the surface will cause the

shaft to rotate irregularly between the grinding wheels whereby one portion of the shaft may be ground away more than another portion, thus producing an uneven surface on the shaft.

Having now described my invention and the principal objects and advantages thereof so that others skilled in the art may clearly understand the same, what I desire to secure by Letters Patent is as follows:

1. The method of grinding cylindrical surfaces on an irregular shaft which comprises, rounding out the irregular portions of the shaft by means of keys of approximately the same hardness as the shaft firmly fixed to the shaft to cover said irregularities and then working the shaft through a centerless grinder.

2. A method of grinding an irregular cylindrical shaft having a key-way formed in the cylindrical portion thereof, and having a flattened end portion which comprises, inserting a key of approximately the same hardness of the shaft in said key-way, inserting a hollow cylindrical cap upon the flattened end of said shaft and working the shaft through a centerless grinder.

3. A method of grinding an irregular cylindrical shaft having a key-way and a flattened portion in the cylindrical portion thereof, and having a flattened end portion which comprises, forming a key having a narrow portion to fit in said key-way and a wide portion with a partly cylindrical surface to cover said flattened portion and forming a continuation of the surface of said cylindrical portion, inserting a hollow cylindrical cap upon the flattened end of said shaft and working the shaft through a centerless grinder.

Signed by me at South Bend, Indiana, this 4 day of November, 1931.

KARL L. HERRMANN.