Nov. 29, 1938. A. J. SIEVERS, JR 2,138,258

CRANKSHAFT GRINDING APPARATUS

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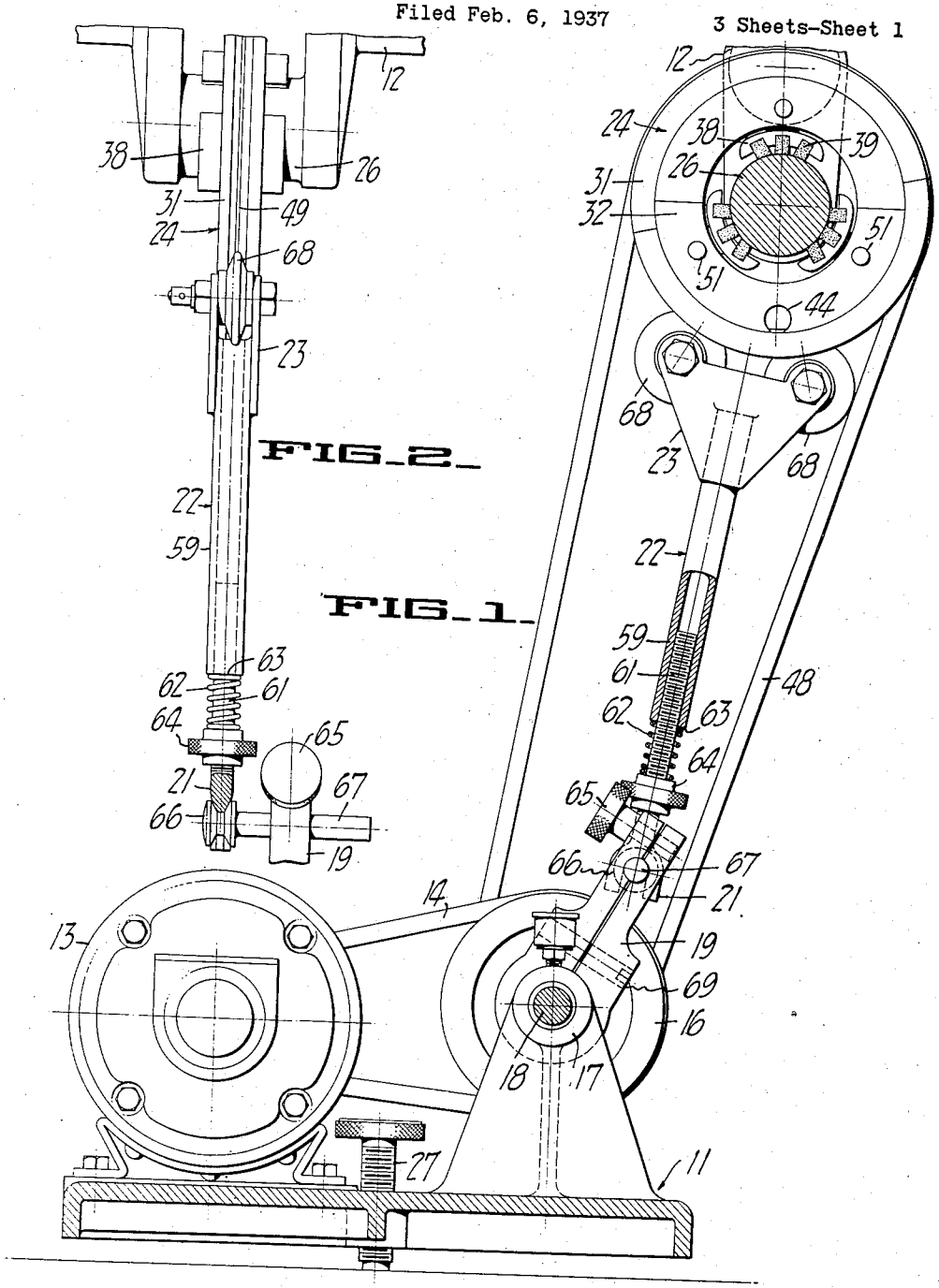


FIG. 2.

FIG. 1.

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FIG. 3.

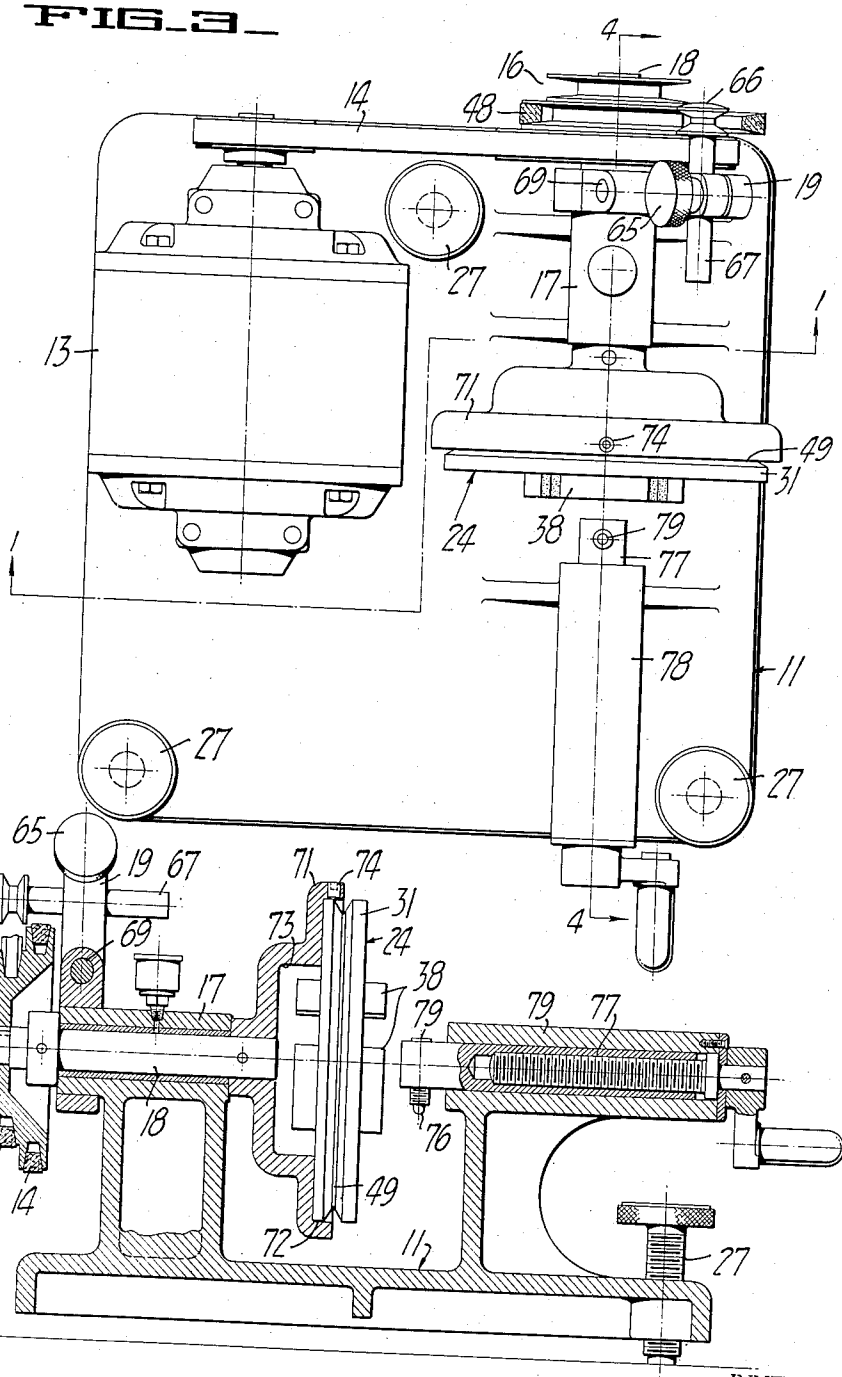


FIG. 4.

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FIG. 5.

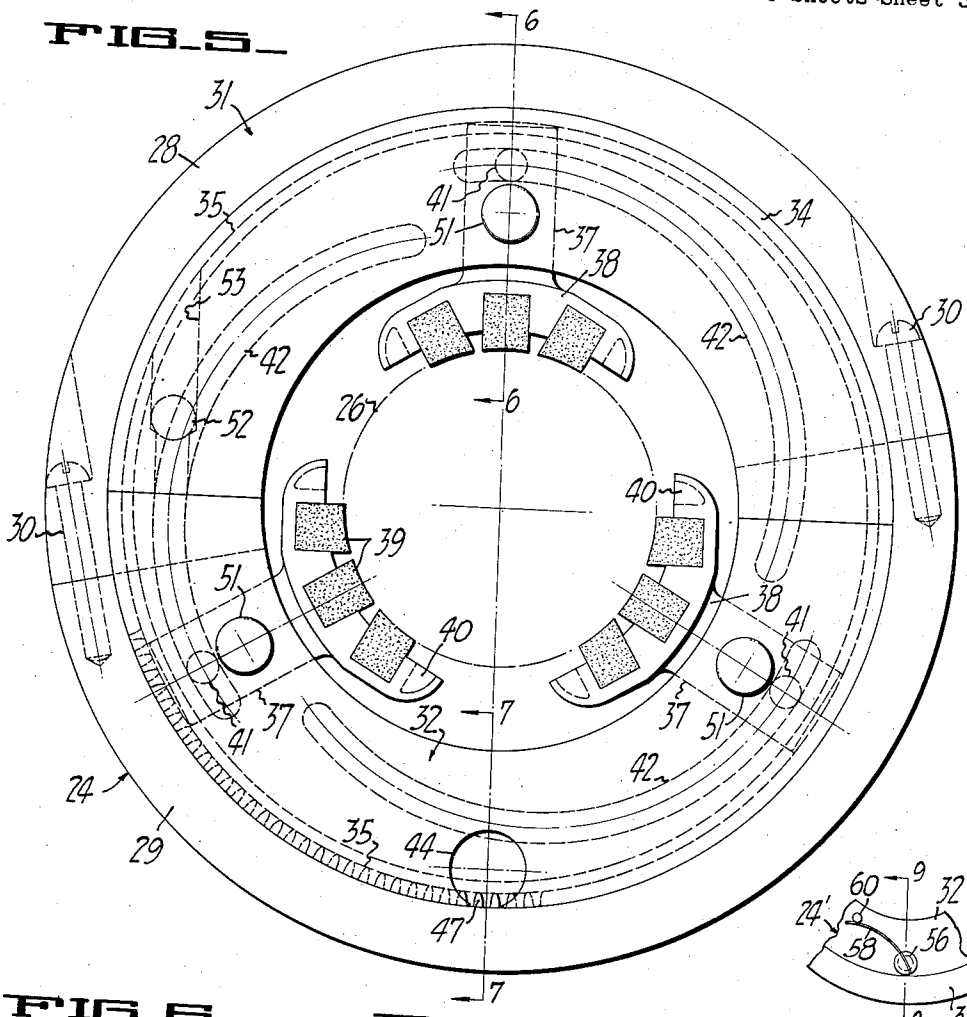


FIG. 6.

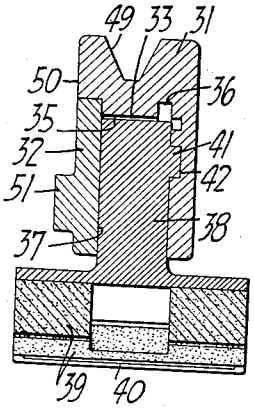


FIG. 7.

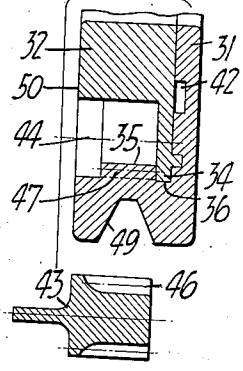


FIG. 8.

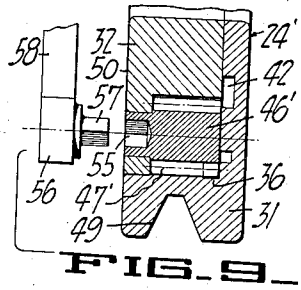


FIG. 9.

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UNITED STATES PATENT OFFICE

2,138,258

CRANKSHAFT GRINDING APPARATUS

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Application February 6, 1937, Serial No. 124,400

11 Claims. (Cl. 51—73)

The invention relates to apparatuses arranged for grinding and truing cylindrical surfaces and more particularly to the crank pin bearings of a crank shaft or the like. The present application forms a continuation, in part, of my co-pending application Serial Number 75,514, filed April 21, 1936.

An object of the invention is to provide an apparatus of the character described which is particularly adapted for grinding and truing crank pins or throws of a crank shaft such as used in reciprocating engines and which may be applied to a crank shaft without requiring the removal of the crank shaft from its support in the engine.

Another object of the invention is to provide an apparatus of the character described which will afford in a single unitary apparatus means for properly cutting and truing the abrasive or grinding elements used in the apparatus prior to grinding of the crank shaft.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawings:

Figure 1 is a side elevation of an apparatus constructed in accordance with the present invention and shown operatively associated with a crank shaft to be ground, portions of the device being broken away and shown in section, and part of the base support of the device being shown in section as taken substantially on the plane of line 1—1 of Figure 3.

Figure 2 is a side elevation of part of the apparatus illustrated in Figure 1.

Figure 3 is a plan view of the base support of the apparatus.

Figure 4 is a longitudinal sectional view taken through part of the base support and substantially on the plane of line 4—4 of Figure 3.

Figure 5 is a front elevation of a part of the grinding apparatus which is attached to the crank shaft.

Figure 6 is a cross-sectional view of the device illustrated in Figure 5 and is taken substantially on the plane of line 6—6 of Figure 5.

Figure 7 is a cross-sectional view of the device illustrated in Figure 5 and is taken substantially on the plane of line 7—7 of Figure 5.

Figure 8 is a fragmentary front elevational view on a smaller scale showing a modified form of the invention.

Figure 9 is a cross-sectional view taken along the line 9—9 of Figure 8.

The apparatus of the present invention, as hereinabove mentioned, is particularly designed for grinding and truing the crank pin bearings of crank shafts and the like, such as used in internal combustion engines of motor vehicles, although, as will be understood, the apparatus may be used for grinding other cylindrical surfaces. With reference to the accompanying drawings, the apparatus comprises a base support 11 which is adapted for positioning on the floor or other ground support under the engine of an automobile or the like, and directly under the crank shaft 12 of the engine. Mounted on the support is a suitable power means 13, such as an electric motor which is connected, as by means of a belt 14 to a rotatable drive means 16 are shown in the form of a plurality of various sized concentrically arranged pulleys. Mounted on the hub support 17 of the pulley shaft 18 and extended upwardly from the support 17 is an arm 19 which supports the lower end 21 of a link or connecting member 22, and the latter in turn supports, at its upper end 23 a rotatable grinding means 24 which is attached to one of the crank pin bearings 26 of the crank shaft 12. In accordance with the present arrangement the base support 11 is positioned so as to dispose the axis of the pulleys 16 substantially parallel to the axis of the crank shaft and is further provided with a set of leveling screws 27 for positioning the general transverse plane of the support substantially parallel to the axis of the crank shaft.

The grinding means 24, as more fully set out in my co-pending application, Serial Number 75,514, aforesaid, comprises an annular member and is formed of detachable half segments 28 and 29 for positioning around the crank pin to be ground. The segments 28 and 29 when assembled may be held in end abutting relation by any suitable means such as screws 30, as shown here, and are each composed of a main body section 31 and a movable section 32 which is carried in an annular recess 33 of the section 31. The section 32 is preferably held in the section 31 for circumferential displacement relative thereto by means of an annular ridge or guide 34 on the section 32 which is fitted into an annular groove 36 of the section 31. Carried in a plurality of radial openings 37 in the section 32 for radial reciprocation therein are a plurality of members

38 which are advanceable in a radial inward direction to engage the periphery of the crank pin or other cylindrical surface to be ground. Preferably, each of the members 38 are formed at their inner face to receive a plurality of abrasive stones or elements 39 which serve on rotation of the assembly to grind the periphery of the surface with which they are engaged.

As an important feature of the invention, the holders 38 of the abrasive members are advanced jointly and simultaneously so that at all times the abrasive stones will be held at substantially equal radii from the axis of the crank pin. This uniform movement of the elements is provided for in the present embodiment by the engagement of pins 41 on the members 38 in a plurality of spiral grooves 42 in the section 31 so that on relative circumferential displacement of the section 32 relative to the section 31 the members 38 will be uniformly radially displaced by the grooves 42. This relative circumferential displacement of the sections may be initially effected by the use of a key 43 which may be inserted into an opening 44 in the section 32 and is formed at its inner end with a pinion 46 which is engageable with a plurality of gear teeth 47 formed over a portion of the inside circumferential face 35 of the section 31.

In accordance with the present invention the abrasive members after initial setting by the key as above explained, may be moved inwardly against the surface being ground during rotation of the assembly around the surface so that the surface may be speedily brought into proper roundness without stopping the rotation of the device for readjustment of the abrasive members. This inward movement of the abrasive members against the work during the grinding of the work is effected in the present embodiment by two assisting constructions. One feature of this arrangement is the utilization of the frictional drag of the abrasive elements on the work, to assist in the inward movement of the grinding members. As will be seen from the drawings, the rotation of the means 24 is effected by applying a rotative force directly to the section 31 such as by means of a belt 48 which engages in a circumferential belt groove 49 in the section 31 and is driven from one of the drive pulleys 16. The means 24 is so postioned around the surface to be ground and with respect to the direction of rotation, that the direction of rotation of the means will be in the direction of a radial outward extension of the spiral grooves 42. Thus, the frictional drag on the abrasive elements against the surface will tend to cause the section 32 to lag behind the section 31 and accordingly set up a circumferential force differential between the sections which force acts through the spiral grooves 42 and the pins 41 to urge the abrasive members inwardly during rotation. In many instances, due to the character of the surface being ground and the relative hardness and consistency of the abrasive used the inward force of the abrasive elements against the work caused by the force differential between the sections, as above explained, may be considerably smaller than that which may be used for efficiently grinding the surface. I have therefore, and in accordance with the second construction above mentioned, mounted on the section 32 at the exposed radial side 50 thereof, a plurality of circumferentially spaced outwardly extending projections 51 which may be struck during rotation of the sections to cause a relative circumferential movement of the sections. Usually this striking action is effected by merely positioning a relatively heavy implement or tool against the side 50 of the section 32, so that during rotation, the projections 51 will strike against the implement so positioned. If desired, and as will be understood, the projections 51 may be replaced by notches, recesses or some other form of irregular surface.

In order that any variant in the rotative force applied to the section 31, such as caused by any non-uniformity in the out-put of the driving mechanism or by vibration or the like shall not be translated into a corresponding variation in the force of the abrasive members against the surface being ground, a check mechanism is preferably employed to prevent a retraction of the abrasive members during rotation. This means, as illustrated in Figure 5, is in the form of a ball clutch consisting of a ball 52 which is carried in a recess 53 at the periphery of the section 32 and is moved by centrifugal force on rotation of the sections into engagement with the inner opposite periphery 35 of the section 31 so that while permitting relative displacement of the sections in a direction tending to increase the pressure of the abrasive members against the surface to be ground, will wedge against and prevent movement of the periphery 35 upon a relative movement of the sections in an opposite direction. On stopping of the rotation the ball will drop to the base of the recess and away from the side 35 to permit a free relative displacement of the sections.

A slightly modified form of the grinding means 24' is illustrated in Figures 8 and 9 wherein the circumferential force differential between the sections during rotation for moving the abrasive elements against the work is established, at least in part, by the resilient spring mechanism. As will be seen from these figures, the toothed peripheral portion 47' of the section 31 is engaged by a pinion 46' carried directly in the body of the section 32. The pinion is provided with a wrench opening 55 for turning of the pinion and for adjustment of the sections and such turning may be effected by an ordinary wrench or by a spring press key 56 here illustrated. This key is provided with a shank 57 which is engageable in the wrench opening 55 and is provided with a transversely extending flat spring 58 which may be flexed to behind a stop 60 for urging the rotation of the key and pinion.

Preferably the abrasive elements 39 are of a considerable width and may extend axially for a greater length than the combined axial width of the sections 31 and 32 but are preferably somewhat shorter than the length of the surface to be ground so that at least a small reciprocation of the abrasive elements lengthwise over the surface during rotation is permitted. This lengthwise movement of the abrasive members not only insures a more perfect finish but also assists in preventing the abrasive elements from clogging up and becoming partially ineffectual and also likely scoring the surface being ground. The holders 38 for the abrasive members are preferably formed adjacent each of their inner opposite circumferential spaced ends with a trough 40 for catching the loss abrasive and preventing the same from escaping into the inner parts of the mechanism.

Due to the pressure of the drive belt 48 tending to draw the rotatable grinding means 24 down-

wardly in the direction of the pulleys 16, and to prevent an uneven grinding of the pin as may be caused thereby, I use the intermediate supporting means 22 for supporting the rotatable grinding means 24 in substantially concentric relation about the crank pin and to offset the downward pressure of the belt 48. This connecting member or link 22 is formed of slidably attached sections 59 and 61 between which is compressed a spring 62 for resiliently urging the sections to an extended positioning and thereby pressing the means 24 away from the pulleys 16 and against the tension of the belt 48. The spring 62 surrounds the section 61 and abuts against an end 63 of the section 59 while the opposite end of the spring is supported on a nut 64 threaded on the section 61 and which nut is effective by its relative position on the section, to regulate the tension of the spring 62. The lower end 21 of the section 61 is forked and shaped to engage over a bearing portion 66 provided on a pin 67 carried by the arm 19. Preferably, and as will be seen in Figures 1 and 4, the pin 67 is adjustably carried by the arm 19 and may be fixed in adjusted position as by means of a clamping screw 65, with the bearing 66 disposed in the plane of rotation of any of the pulleys 16 so that the supporting member 22 may be positioned in the plane of the belt 48. Also, preferably, the engagement of the end 21 on the bearing 66 is such as to enable a small fulcruming of the member 22 about the lower end 21 so as to reciprocate the rotatable grinding member 24 longitudinally of the crank pin 26, during rotation of the means 24. The upper end 23 of the section 59 of the member 22 is provided with a pair of spaced rollers 68 which are engageable in the pulley groove 49 of the section 31 of the means 24 so as to rotatably support the means 24. In order to accommodate the apparatus for grinding crank pins as various distances above the base support 11, and without requiring a change in length of the belt 48, the arm 19 is preferably rotatably secured to the hub 17 and is arranged to be fixed in various circumferential positions relative thereto as by means of a clamping screw 69 so as to vary the vertical positioning of the pin 67.

Prior to the grinding of a distorted cylindrical surface, the abrasive stones are preferably cut and trued to the curvature to which the surface is to be finished so that a maximum abrasive surface will be presented to the work and a uniform and precise abrasive action is insured. The means for cutting and truing the stones, and, as will be seen from Figures 3 and 4, is embodied as a principal part of the present apparatus and consists of a rotatably driven disc member 71 which is mounted on an end of the pulley shaft 18 and is formed with concentric cylindrical seats 72 and 73 for receiving the periphery of the section 31 and the periphery of the stone or abrasive holder members 38. The section 31 of the rotatable grinding means 24 may be fastened in the seat 72 by means of a plurality of fastening screws 74 carried by the member 71 at the seat 72. A cutting tool 76 such as a diamond point or the like, is advanceable axially of the disc member 71 for engagement with the abrasive stones by means of a manually operated feed screw 77 supported in a housing 78 carried by the base support 11 in axial alignment with the shaft 18. The cutting tool 76, as here shown, is mounted at the end of a screw 79 carried transversely through an end of the feed screw 77 and may be adjusted transversely by means of the screw for cutting various radii of curvature of the inner faces of the abrasive elements.

I claim:

1. A crank shaft grinding apparatus for automobiles and the like comprising, a base support adapted for positioning under an automobile and under the crank shaft thereof, power driven rotatable means carried by said support with the axis of rotation thereof adapted for positioning substantially parallel to the axis of rotation of said shaft, means for adjusting the plane of said support for positioning the same substantially parallel to said shaft, rotatable grinder means arranged for assembly around one of the crank shaft bearings, means adjustable in length for supporting said grinder means from said base support in concentric relation around said bearing, and flexible drive means connecting said first and second means.

2. An apparatus for grinding the crank shaft pin bearings of an automobile or the like without removing the crank shaft from the motor of the automobile or the like comprising, a base support adapted for positioning under said crank shaft for support independent thereof, power driven rotatable means carried by said base support, grinding means arranged for assembly around a pin bearing of said crank shaft and effective on rotation thereof around to grind said bearing, a drive belt connecting said first and second means for rotation of said second means around said bearing, and a resiliently expansible member supporting said grinding means from said base support in concentric relation around said pin bearing.

3. An apparatus for grinding crank shaft pin bearings and the like comprising, a support, power driven rotatable means carried by said support and adapted for positioning of the axis of rotation thereof substantially parallel to the axis of said shaft, grinder means comprising, a segmental wheel adapted for assembly around one of the crank pin bearings and having an abrasive element arranged for engagement with said bearing for grinding the same on rotation of said wheel, said wheel being provided along its circumference with a belt groove, a belt connecting said wheel and power driven rotatable means, and means for supporting said wheel from said support in concentric relation around said pin and bearings and comprising, a member mounted at one end on said support and a pair of spaced rollers mounted on the opposite end of said member and engageable in said belt groove of said wheel.

4. An apparatus for grinding crank shaft pin bearings and the like comprising, a support, power driven rotatable means carried by said support and adapted for positioning of the axis of rotation thereof substantially parallel to the axis of said shaft, means adapted for assembly around a crank pin bearing of said shaft and provided with an abrasive element effective to grind said bearing on rotation of said means, drive means connecting said first and second named means, and a member mounted on said support and supporting said grinder means in substantially concentric relation around said pin bearing and comprising, a pair of adjustably attached sections, and a spring urging an extension of said sections.

5. An apparatus for grinding crank shaft pin bearings and the like comprising, a support, power driven rotatable means carried by said support and adapted for positioning of the axis of rotation thereof substantially parallel to the

axis of said shaft, means adapted for assembly around a crank pin bearing of said shaft and provided with an abrasive element effective to grind said bearing on rotation of said means, drive means connecting said first and second named means, and a member mounted on said support and supporting said grinder means in substantially concentric relation around said pin bearing and comprising, a pair of slidably attached telescopic sections, a spring connecting said sections and resiliently urging the same to an extended position, and means adjustably positioned on one of said sections and engageable with said spring for controlling the expansible force of said spring against said sections.

6. An apparatus for grinding crank pin bearings of a crank shaft or the like without removing the shaft from its engine mounting comprising, a base support adapted for mounting in spaced relation to said shaft, power driven rotatable means carried by said support and arranged for positioning of the axis of rotation thereof substantially parallel to said shaft, rotatable grinder means adapted for assembly around a pin bearing of said shaft, drive means connecting said first and second means, an arm on said support providing a bearing portion intermediate said first and second means, said bearing portion having an axis substantially parallel to the axes of said first and second means, and a member provided with a forked end engageable with said arm bearing portion and engageable with said rotatable grinder means for supporting the latter in substantially concentric relation around said pin bearing and being adapted for fulcruming on said arm bearing portion at right angles to its axis to displace said grinder means longitudinally on said pin bearing.

7. An apparatus for grinding crank pin bearings of a crank shaft or the like without removing the shaft from its engine mounting comprising, a base support adapted for mounting in spaced relation to said shaft, power driven rotatable means carried by said support and arranged for positioning of the axis of rotation thereof substantially parallel to said shaft, rotatable grinder means adapted for assembly around a pin bearing of said shaft, drive means connecting said first and second means, an arm on said support intermediate said first and second means and radially extending from said first means and adjustable about the axis thereof, and means supported on said arm and engageable with said second named means for supporting the latter in concentric relation around said crank pin bearing.

8. An apparatus for grinding the crank pin bearings of a crank shaft or the like comprising, a base support arranged for positioning opposite to and spaced from said crank shaft, a plurality of concentric drive pulleys carried by said support, a rotatable grinding means adapted for assembly around a crank pin bearing, belt means for driving said grinding means from said pulleys, an arm carried by said support and radially extending from the axis of said pulleys and having a portion overlying said pulleys, and means mounted on said portion and engageable with said grinding means for supporting the latter in substantially concentric relation around said pin, said portion being adjustable relative to said arm for positioning opposite to each of said pulleys.

9. A crank shaft grinding apparatus for automobiles and the like comprising, a base support adapted for positioning under an automobile and under the crank shaft thereof, power driven rotatable means carried by said support with the axis of rotation thereof adapted for positioning substantially parallel to the axis of rotation of said shaft, means for adjusting the plane of said support for positioning the same substantially parallel to said shaft, rotatable grinder means arranged for assembly around one of the crank shaft bearings, means supporting said grinder means from said base support in concentric relation around said bearing, and drive means connecting said first means and said grinder means.

10. A device for grinding cylindrical surfaces or the like comprising, a ring member adapted for mounting around said surface, a plurality of members carried by said ring member and movable radially thereto for engagement with said surface, means effective to move said members jointly and equally in a radial direction relative to said ring member, a spring means for actuating said last named means.

11. A device for grinding cylindrical surfaces or the like comprising, a ring member adapted for mounting around said surfaces and having sections movable relative to each other circumferentially, a plurality of members carried by said ring member and being movable radially with respect thereto for engagement with said surface, means actuated by a circumferential force differential between said sections to urge said second named members radially inwardly with respect to said ring member, a gear portion on one section, a pinion carried by the other section and engageable with said gear portion, and spring means connected to said pinion and urging rotation of the latter and establishing the aforesaid force differential.

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