Feb. 24, 1953 E. A. FUGLIE 2,629,213

CRANKSHAFT GRINDING DEVICE

Filed June 3, 1950 4 Sheets-Sheet 1

Fig. 1.

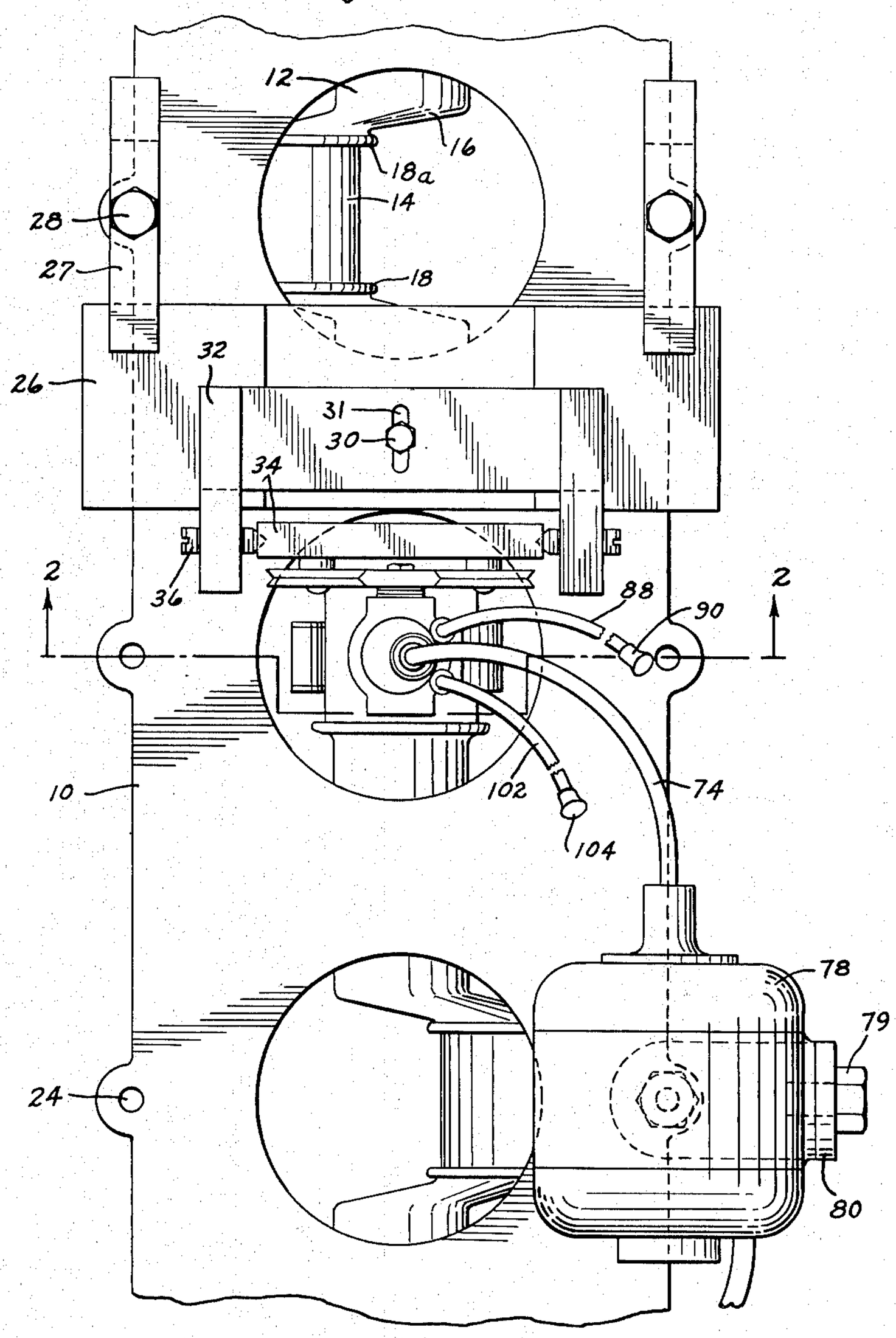

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Fig. 2.

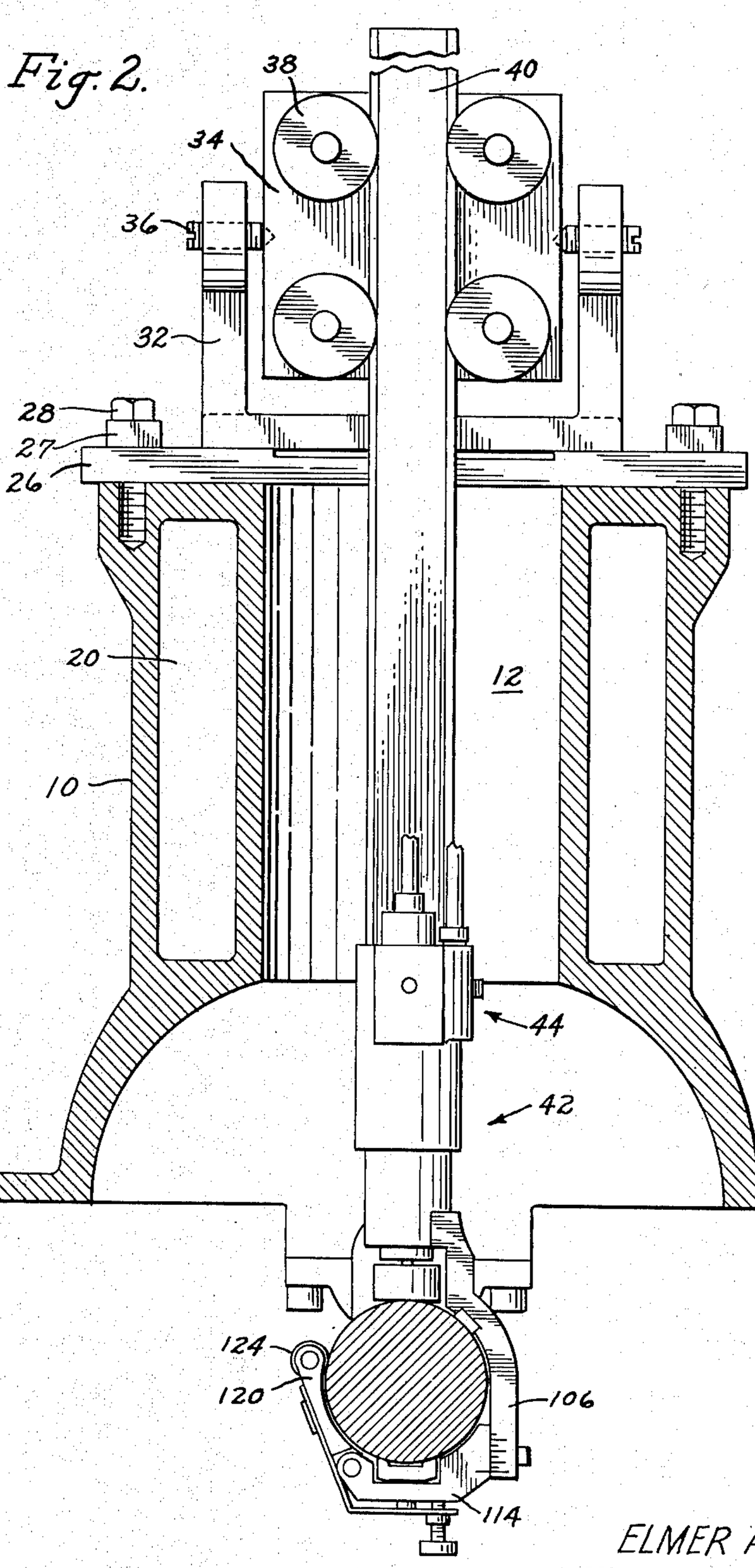

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Fig. 3.

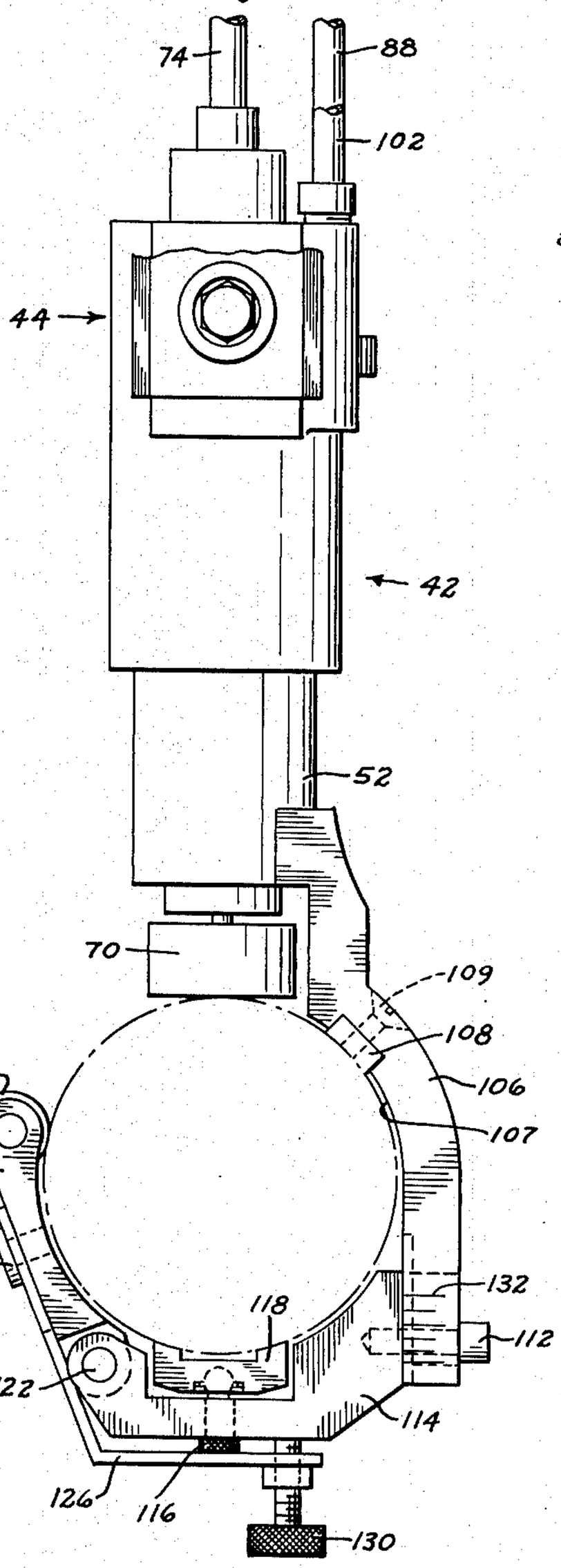

Fig. 8.

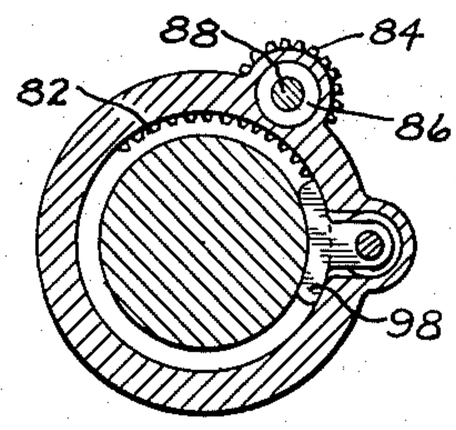

Fig. 9.

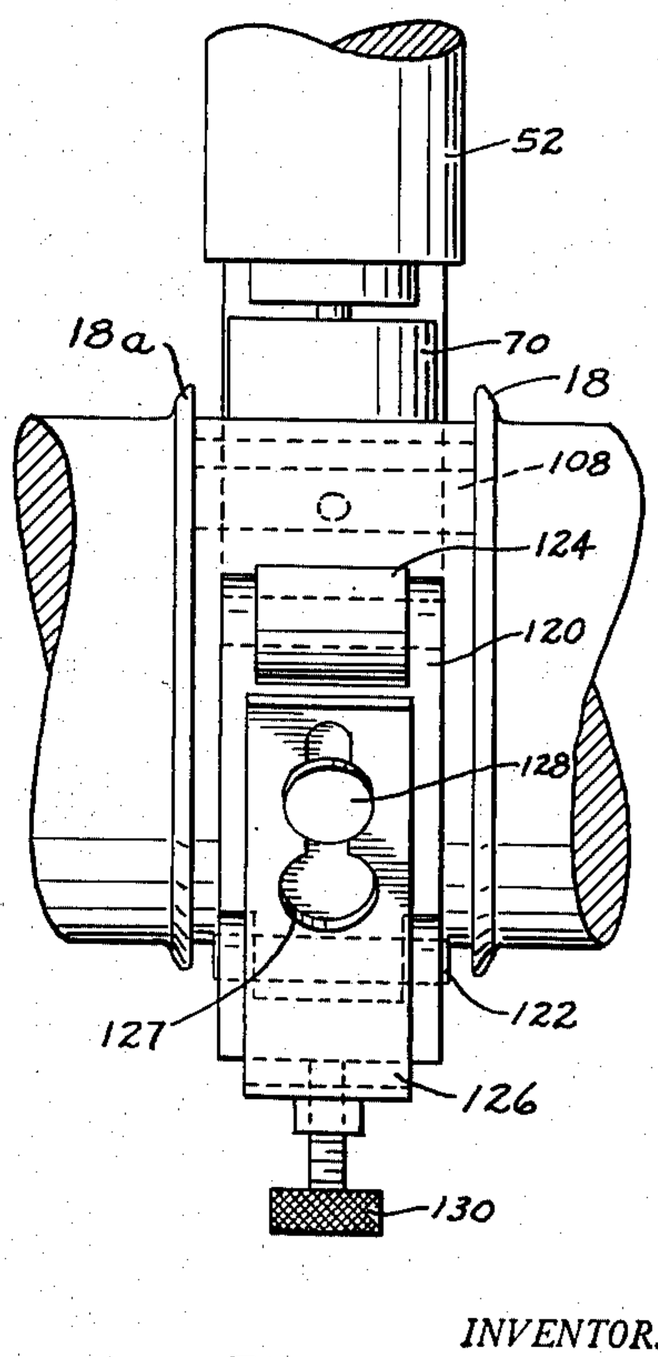

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Fig. 4.

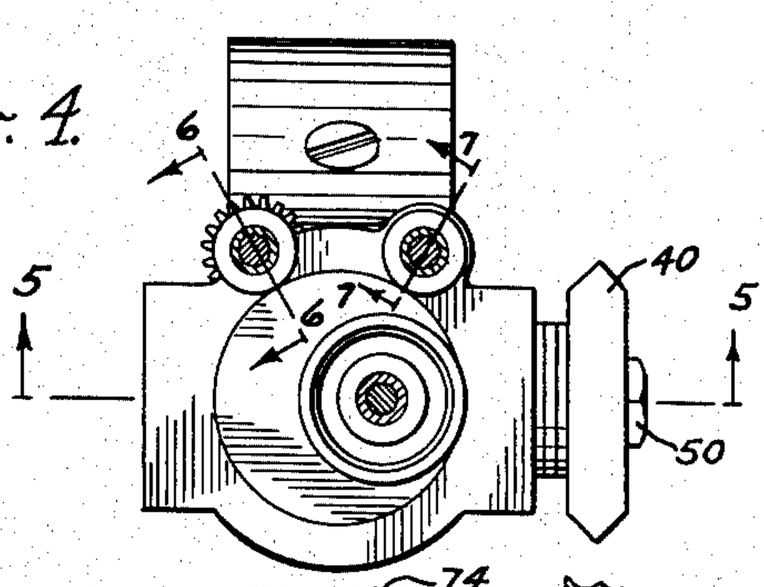


Fig. 5.

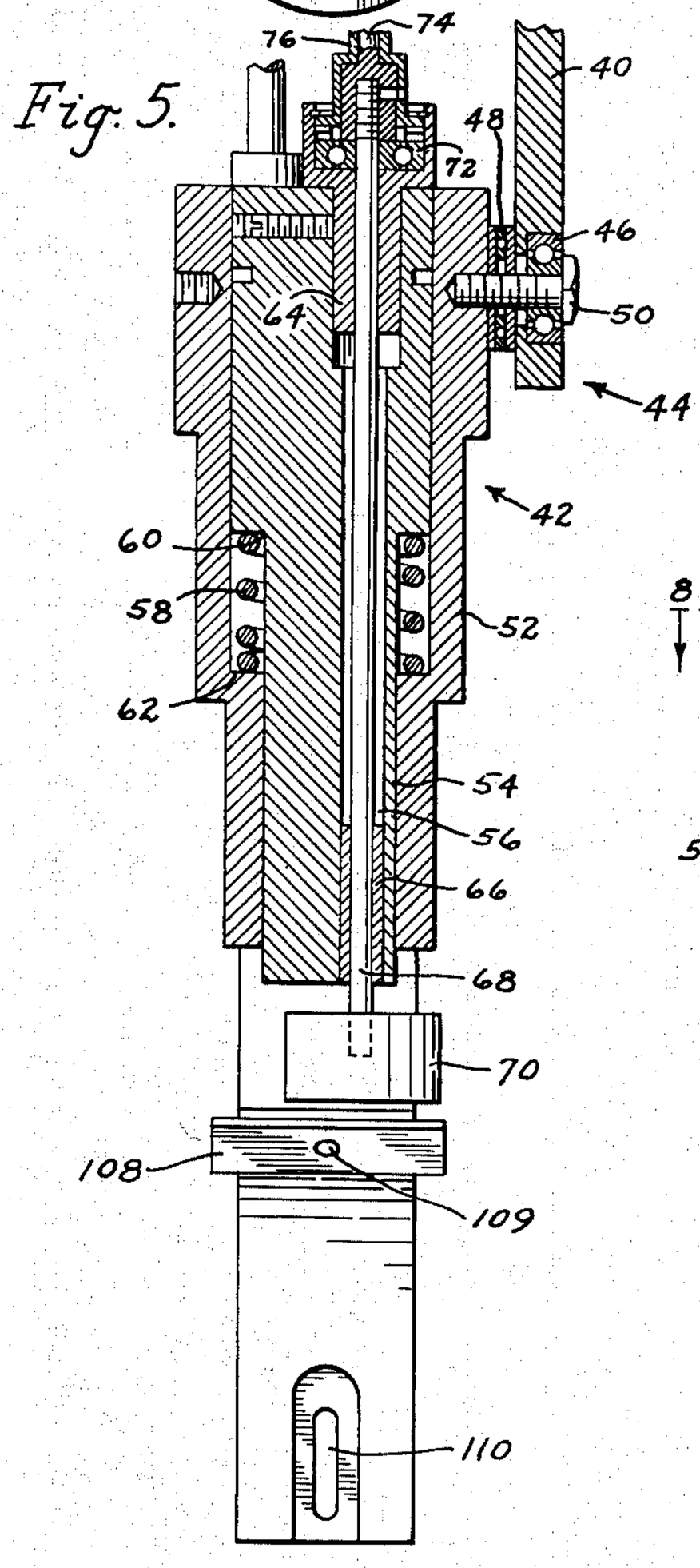


Fig. 6.

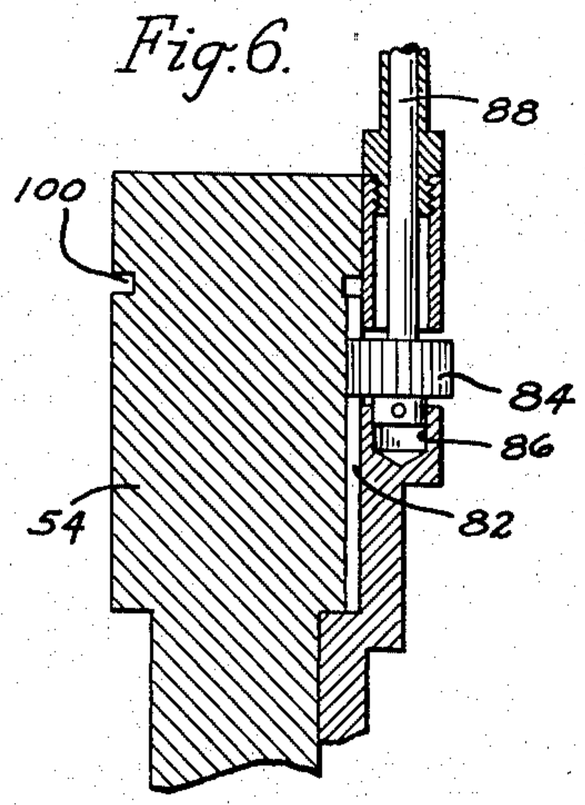
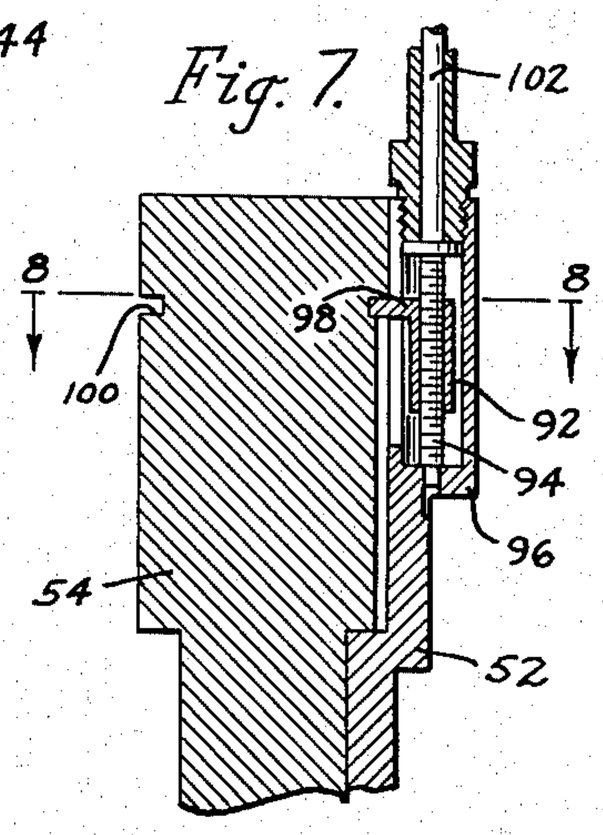


Fig. 7.



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Patented Feb. 24, 1953

2,629,213

UNITED STATES PATENT OFFICE

2,629,213

CRANKSHAFT GRINDING DEVICE

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Application June 3, 1950, Serial No. 165,941

6 Claims. (Cl. 51—241)

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My invention relates to improvements in a crankshaft grinding device. In general it is related to a device which is adapted for mounting on or in an engine block or other similar support for grinding the bearings of a crankshaft which is supported for rotation beneath the engine block or support. More particularly the invention is concerned with a device which is supported for vertical reciprocating movement and in which several adjustments can be made for properly grinding the bearing surfaces of a rotating shaft, such as a crankshaft, without having to remove the device from its mountings on the engine block or other support.

The present invention is primarily intended for use in repair shops as distinguished from machines which are used in factories for performing the original grinding of the bearings.

As the crankshafts and bearings of each particular type of engine may vary somewhat in diameter and width, it is impractical for a repair shop to be equipped with special grinding tools for each individual type of engine. It is important, therefore, that a grinding tool which is intended for general use, such as in an automotive repair shop, be sufficiently adjustable so that it can be satisfactorily used on the crankshafts of virtually any type of engine.

In the present invention the grinding device is supported by a head mechanism which is passed through an opening in the engine block and then suitably clamped about the bearing to be ground, with the grinding wheel positioned above the bearing so as to rotate about an axis which is transverse to the axis of the bearing. An elongated shaft or guide rod is pivotally connected to the head member to permit the head member to oscillate with the bearing as the crankshaft is rotated. The guide rod in turn extends between a set of guide rollers which are supported on the top of the engine block so that as the crankshaft is rotated, the head member and guide rod will reciprocate vertically, with the guide rod being guided by the rollers. In order that the head assembly be adapted for clamping on any one of a number of different sized bearings, it is provided with an extended arm that adjustably supports a clamping means that is adapted to surround a portion of the bearing. To provide further accurate adjustment, a vernier adjustment is provided which adjusts the tension on a roller element that contacts the bearing surface. It is an important feature of the present invention that the adjustment between the head member and its associated parts

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with the bearing surface be made from beneath the crankshaft since this provides an accessible means for making adjustment without removing the device either from the bearing or from its mountings on the engine.

As the particular bearing which is being ground may be unevenly worn or grooved, means are provided for adjustably moving the grinding wheel in a vertical direction relative to the bearing to thereby grind the bearing to a cylindrical surface. This adjustment is made by means which is operably connected through the head to the grinding wheel and which may be reached from the upper surface of the engine block.

Since the bearings of different crankshafts may vary somewhat in width, and to avoid the necessity of having to maintain a large number of grinding wheels of differing diameters, in the present invention a grinding wheel of relatively small diameter is used and means are provided for laterally moving the wheel between the opposite walls of the bearing but without changing its vertical position relative to the bearing. This adjustment is made by eccentrically rotating the wheel through the arc of a circle and with the lower grinding surface of the wheel always being held in the same horizontal plane. Like the adjustment mentioned above, this lateral adjustment is also made from a point above the engine block.

Frequently the bearing will have a tapered surface which cannot be satisfactorily removed by either of the adjustments mentioned heretofore. To remove the tapered surface, means are provided for adjusting the position of the guiding means so as to slightly tilt the entire mechanism including the grinding wheel so that in effect only a portion of the grinding wheel contacts the bearing surface.

To drive or rotate the grinding wheel, an electric motor is provided which is pivotally supported above the engine block and connected to the wheel by a flexible drive shaft. By pivotally supporting the motor and using a flexible drive shaft, the motor is enabled to flexibly rock on its mounting without interfering with the reciprocating movement of the mechanism nor the several adjustments heretofore mentioned.

An object of the invention is to provide a crankshaft grinding device which is adapted to fully and properly grind the bearings of a crankshaft while the same is rotatably mounted in an engine block.

Another object is to provide in a device of the

class described, means for adequately adjusting the device to bearings of differing diameters.

Another object is to provide in a device of the class described means for moving the grinding wheel in two different planes with respect to the bearing while the grinding operation is in process to thereby form a true cylindrical bearing surface over a relatively wide area.

Another object is to provide means for adjustably tilting the grinding wheel relative to a bearing so as to bring only a portion of the wheel into contact with the bearing.

A further object is to provide in a device of the class described, a head mechanism which is adapted to be adjustably clamped to a bearing surface, together with means for adjustably positioning a grinding device carried by the head, and means for supporting the head for both oscillatory and reciprocatory movement so that grinding of a crank bearing of a crankshaft may be suitably performed without removing the crankshaft from its normal mountings in an engine.

Other and further objects may become apparent from the following description and claims and in the appended drawings in which:

Fig. 1 is a plan view of an engine block showing the present invention mounted in place thereon with a portion extending through to a crankshaft;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is an enlarged side elevation of a portion of the structure shown in Fig. 2;

Fig. 4 is a plan view of the structure shown in Fig. 3;

Fig. 5 is a vertical cross-section taken on line 5—5 of Fig. 4 looking in the direction of the arrows;

Fig. 6 is a vertical cross-section taken on line 6—6 of Fig. 4 looking in the direction of the arrows;

Fig. 7 is a vertical section taken on line 7—7 of Fig. 4;

Fig. 8 is a plan view taken on line 8—8 of Fig. 7; and,

Fig. 9 is a view of a part of the structure shown in Fig. 3 as seen from the left hand side thereof.

Referring now to the several views of the drawing, the invention will be described in detail. Referring first to Figs. 1 and 2, reference numeral 10 indicates an engine block from which the head portion has been removed. A series of cylindrical openings 12 extend through the block and form chambers through which piston connecting rods, not shown, pass and are joined at their lower ends to bearing surfaces 14 of a conventional crankshaft 16. The bearings 14 at their opposite lateral sides have wall portions indicated at 18 and 18*a* which constitute the lateral extremities of each of the bearing surfaces. The engine block has the usual water jacket indicated at 20 in Fig. 2, and the block also is provided with a series of bolt holes 24 by means of which the head portion, not shown, is secured to the engine block 10.

The present invention constitutes a device which is adapted to be mounted on top of the engine block and consists of a flat plate 26 which rests on the upper surface of the engine block and is secured in place by hold down members 27 acted on by bolts 28 which pass through and are secured in the apertures 24. Adjustably secured for lateral movement on plate 26 by means of a bolt 30 which passes

through a slot 31 is a U-shaped member 32. Within the hollow open center portion of member 32 a plate 34 is pivotally supported by means of a pair of pointed screws 36. The plate 34 in turn supports a plurality of guide rollers 38 whose peripheries are grooved to receive the bevelled edges of a sliding guide rod 40.

At its lower extremity the guide rod 40 is pivotally connected to a head member indicated by the general reference numeral 42 by means of a pivotal connecting member indicated generally at 44. As best seen in Fig. 5, the pivotal mounting connection 44 consists of roller bearing assemblies 46, 48 which are supported by the rod 40 and between the rod 40 and the head member 42 by a threaded bolt 50. It might here be stated that the pivotal connecting member 44 is intended to permit oscillatory movement of the head member 42 relative to the guide rod 40, so that as the head member 42 rotates with the crankshaft 16, a vertical movement will be transmitted to the guide rod 40 to enable the latter to vertically move between the guide rollers 38.

Referring now to Figs. 3–9, and particularly to Fig. 5, the head assembly indicated by general reference numeral 42 consists of a cylindrical casing 52 which supports in its interior a rotatable member in the form of an elongated tubular bearing member 54 which has an eccentrically disposed vertically extending interior bore 56. A coil spring 58 extends between a shoulder portion 60 of the member 54 and a shoulder portion 62 of the casing 52 and biases member 54 upwardly relative to the casing 52, for a purpose to be described in detail hereinafter.

Extending vertically through the eccentrically disposed bore 56 of member 54 and journalled in bearing members 64, 66 is a vertically disposed drive shaft 68 which at its lower end is connected to a surface finishing member disclosed as a cylindrical abrasive grinding wheel 70. At its upper end the shaft 68 is journalled in a bearing member 72 and is connected to a flexible drive shaft 74 which extends through a ferrule 76. The flexible drive shaft 74 is shown in Fig. 1 as extending from an electric motor 78 which is pivotally supported at 79 on a bracket 80, which in turn is secured on the head of the engine block 10. The flexible drive shaft 74 is normally encased in an armored cable, not shown.

Referring now to Figs. 4, 6 and 8, the rotatable member 54 at its upper end carries a semi-circular geared surface 82 which, as seen in Fig. 6, is quite extensive in a vertical direction. The gear teeth of surface 82 mesh with a small pinion gear 84 that is journalled in a bearing 86, and is connected to a flexible shaft 88. As shown in Fig. 1, shaft 88 extends upwardly adjacent the guide rod 40 and its outer end is connected to a manually rotatable knob 90.

Referring now to Fig. 4 in conjunction with Fig. 7, is shown a tubular member 92 which has a threaded interior that surrounds a threaded shaft 94 that is journalled in a bearing member 96. The member 92, as shown in Fig. 8, has an arcuate upper extremity 98 which extends into a grooved portion 100 of the bearing member 52 above the geared surface 82. The threaded shaft 94 is connected to a flexible shaft 102, which, as shown in Fig. 1, extends upwardly through the opening 12 in the engine

block and at its outer end is connected to a manually adjustable knob 104.

Referring now to Fig. 3 in conjunction with Figs. 2 and 4, an arm 106 extends from the lower portion of the head member 42 and at its upper end is secured to the casing portion 52. Arm 106 has an inner curved surface 107 which carries an abutment member 108 that is provided with arms which extend on either side of the arm 106 and are adapted to engage the inner surface of the side walls 18 and 18a of the bearing 14, as is best seen in Fig. 9. The abutment member 108 is detachably held on arm 106 by a bolt 109. At its lower end arm 106 carries a bearing support 114 which is adjustably connected to arm 106 by a bolt 112 that fits within an elongated slot 110. On its upper surface the support 114 carries a bearing 118 whose position may be adjusted by a set screw 116 so as to bring the bearing 118 into contact with the crank pin bearing 14. An arm 120 is pivotally connected to the support 114 by means of a pin 122, and the arm 120 at its outer end carries a roller member 124 which is adapted to engage the surface of bearing 14 on a side opposite from arm 106. An angularly shaped spring member 126 which is provided with a slotted opening 127 extends between the under surface of the support 114 and a lug member 128 on arm 120 that slidably fits within the opening 127. The angular spring 126 is made adjustable with respect to arm 120 by a large thumb screw 130 which is adapted to engage the under surface of the support 114.

The operation of the device will now be explained in detail. With the head of the engine, not shown, removed, the plate 26 is suitably mounted on the head of the engine block 10 and the head assembly 42 together with all of its parts is passed downwardly through the opening 12 in the engine block. The arm 106 and the supporting assembly are then suitably adjusted about the lower portion of the bearing. This is accomplished with the spring 126 removed and the support 114 brought into contact with the lower surface of the bearing whereafter bolt 112 is tightened into place. If need be, the support 114 is adjusted by means of a series of scale markings on the lower extremity of the arm and indicated in Fig. 3 by reference numeral 132. Then arm 120 is brought into contact with bearing 14 so that the roller 124 engages the outer surface of the bearing. Thereafter the spring 126 is mounted in place with the slotted opening 127 fitting over lug 128 and a suitable tension is placed on the spring by means of the thumb screw 130. This arrangement provides a triangular bearing surface on three sides of bearing 14 formed by roller 124, bearing 118 and the abutment 108 carried by arm 106. The purpose of these adjustments is to accommodate the device to bearings of differing diameters and at the same time, to firmly anchor the head assembly 42 with respect to bearing 14. Moreover, the arrangement provides for adjustment from a point beneath the crankshaft, so that if further adjustment is made during the grinding operation, this may be accomplished without having to remove the device from the engine block.

The position of the grinding wheel 70 is adjusted with respect to the bearing in three different ways. First, the wheel 70 is moved vertically with respect to the bearing 14 by rotation of the knob 104 which through the flexible cable 102 and the threaded member 94 brings about vertical movement of member 92. Member 92 through its arcuate portion 98 that extends into the horizontal groove 100 is capable of depressing member 54 against the resilience of spring 58 so as to move the member 54 downwardly within the casing 52 to thereby vertically move the grinding wheel 70 in the direction of the bearing surface 14. Since member 54 is held in its depressed position against the resilience of spring 58, rotation of the knob 104 in the opposite direction will cause a release of pressure against the spring 58 to thereby permit member 54 to move upwardly within casing 52.

Second, as shown in Fig. 9, the grinding wheel 70 is of a width which is substantially less than the face of the bearing between the opposite walls 18 and 18a. In order to grind the bearing surface between the walls 18, 18a, the hand knob 90 is rotated, which through the flexible cable 88 and the pinion gear 84 causes rotation of member 54 about its central axis. Since the driven shaft 68 is eccentrically mounted within member 54, rotation of member 54 causes the driven shaft and the grinding wheel 70 to be arcuately or eccentrically rotated. Because the geared surface 82 extends arcuately about one-half of the outer surface of member 54, member 54 may be rotated through an arc of 180° to thereby cause the grinding wheel to be moved laterally through a slight arc between the opposite walls 18 and 18a of the bearing 14. It will be noted that the geared surface 82 is substantial in its vertical dimension and, therefore, the pinion gear 84 will engage this geared surface even though member 54 be raised or lowered by means of the knob 104 and its associated parts.

Third, the bearing 14 may be worn in such a manner that its diameter tapers slightly from one of the walls 18, 18a to the other. To make the bearing a true cylinder it may be necessary to tilt the grinding wheel 70. To accomplish this, the head assembly 42 and the guide rod 40 and the guide plate 34 must be tilted. This is accomplished by loosening bolt 30 in slot 31 and slightly moving the U-shaped member 32. Since the abutment 108 engages the inner sides of walls 18, 18a, plate 34 will rotate on the pointed screws 36 and give a tilted position to the whole assembly including the abrasive wheel 70 so that only a part of its lower surface will engage the bearing 14.

When the grinding operation is ready to start, motor 78 is started and through the flexible cable 74 the grinding wheel 70 is driven. To grind the bearing 14 in a true cylinder, it is necessary to slowly rotate the crankshaft 16, and this is accomplished by means, not shown, which may be either through the normal starting motor or by some other motive power which slowly rotates the crankshaft. Thus the grinding operation takes place while the crankshaft 16 is rotating and the adjustment of the grinding wheel 70 is accomplished in the manner previously described.

Insofar as the clamping arm 106 and its associated parts are concerned, adjustments are made before the grinding or finishing operation commences. It is essential that the abutment member 108 be of the proper size since the outer ends of its arms should engage the walls 18, 18a. For this purpose interchangeable abutment members are necessary. During the grinding operation the diameter of the bearing 14 will be slightly diminished but spring 126 will compensate for this condition by continuously urging roller 124 against the bearing. If, however, further adjustment is necessary, the same may be made from

beneath the crankshaft without removing the structure from the engine block.

Since the crankshaft 16 is in continuous rotation during the grinding operation, the head assembly 42 must oscillate with the bearing 14 and this is accomplished through the pivotal connection 44 with the guide rod 40. The flexible shaft 74 will also reciprocate with the head assembly 42 and this will impart a rocking movement to motor 78 on its pivotal connection 79 with the bracket 80. The other flexible shafts 88 and 102 may, if desired, be loosely tied to the armored cable, not shown, that surrounds shaft 74.

The advantages of the present invention reside in providing a device which may be quickly and easily mounted on a suitable support and which is adjustable in several respects so as to accommodate it to different types of work surfaces, and wherein these adjustments may be readily made while the grinding operation is in progress or without removing the device from its mounting.

My invention is defined in the terms of the appended claims.

I claim:

1. A device for grinding the crank pins of a crankshaft while positioned in an engine block, comprising a driven shaft supporting a cylindrical grinding wheel with its flat end face tangent to a crank pin and on the side thereof toward the engine cylinder, a bearing member having an eccentrically disposed bore forming a support for the shaft, a casing engaging the outer surface of the bearing member, clamping means carried by the casing and engaging the crank pin on a side opposite the grinding wheel whereby the casing and its associated parts reciprocate with the crank pin when the crankshaft is rotated, a guide rod extending into the cylinder and pivotally connected to the casing, guide means supported on the engine block and engaging the guide rod and arranged to permit sliding of the guide rod longitudinally of the cylinder, a first manually operable means journalled in the casing and connected with the bearing member for rotating the same about its central axis to arcuately move the grinding wheel in a plane parallel with the axis of the crank pin, and a second manually operable means journalled in the casing and connected with the bearing member to move said member in a plane perpendicular with the axis of the crank pin.

2. A device for grinding the crank pins of a crankshaft while positioned in an engine block, comprising a member engageable with a crank pin and having a bearing for a grinding wheel shaft extending perpendicularly to the crankshaft and on the side thereof toward the engine cylinder, a grinding wheel shaft mounted in the bearing and carrying a cylindrical grinding wheel with its flat end face tangent to the crank pin, driving means extending into the cylinder and connected with the grinding wheel shaft, guiding means extending into the cylinder and pivotally connected to said member to reciprocate with said member when the crankshaft is rotated, a guide support mounted on the upper surface of the engine block, connecting means adjustably joining the guide support to the engine block permitting longitudinal movement of the guide support relative to the engine block, and pivotal means connecting the guide means to the guide support to effect tilting movement of the grinding wheel with respect to the crank pin to remove a taper on the crank pin when the guide support is moved relative to the engine block.

3. A device for grinding the crank pins of a crankshaft while positioned in an engine block, comprising a member engageable with a crank pin and having a bearing for a grinding wheel shaft extending perpendicularly to the crankshaft and on the side thereof toward the engine cylinder, a grinding wheel shaft mounted in the bearing and carrying a cylindrical grinding wheel with its flat end face tangent to the crank pin, driving means extending into the cylinder and connected with the grinding wheel shaft, a guide rod extending into the engine cylinder and pivotally connected at its lower end to said member to reciprocate as the crankshaft is rotated, guide means forming a sliding connection with the upper part of the guide rod, a guide block carried on the upper surface of the engine block having arms extending on either lateral side of the guide means, pivotal means joining the arms of the guide block and the guide means, and means forming an adjustable connection between the guide block and the engine block for adjusting the position of the guide block in a longitudinal direction with respect to the engine block to permit tilting of the grinding wheel relative to a crank pin to remove a taper on the pin.

4. In a device for grinding the crank pins of a crankshaft while positioned in an engine, including a member engageable with a crank pin and having a bearing for a grinding wheel shaft extending perpendicularly to the crankshaft and on the side thereof toward the engine cylinder, a grinding wheel shaft mounted in the bearing and carrying a cylindrical grinding wheel with its flat end face tangent to the crank pin, a guide rod extending into the engine cylinder and pivotally connected at its lower end to said member to reciprocate as the crankshaft is rotated, at least one guide roller engaging opposite lateral sides of the upper end of the guide rod, a block forming a support for the guide rollers, a U-shaped member carried on the upper surface of the engine block and partially surrounding the support for the guide rollers, pivotal means joining opposed portions of the U-shaped member with the sides of said support, and an adjustable connection between said U-shaped member and the engine block operable to permit sliding movement of the U-shaped member in a longitudinal direction with respect to the engine block.

5. A device for grinding the crank pins of a crankshaft while positioned in an engine block, comprising a driven shaft supporting a cylindrical grinding wheel with its flat end face tangent to a crank pin and on a side thereof toward the engine cylinder, a cylindrical bearing having an eccentrically disposed bore forming a support for the shaft, said bearing having a geared surface about a portion of its periphery adjacent the upper extremity thereof, said bearing having a groove formed therein on one end of the geared surface, a casing engaging a portion of the outer surface of the bearing, a spring between the bearing and the casing and biasing the bearing upwardly within the casing, means carried by the casing and engaging the crank pin on a side thereof opposite the grinding wheel, a pinion gear journalled in the casing and engaging the geared surface on the bearing for eccentrically moving the grinding wheel with respect to the crank pin, a feed screw journalled in the casing and operatively engaging the groove in the bearing to vertically move the bearing with respect to the

casing, and manually operable means connected to each of said gears and extending upwardly through the engine cylinder for controlling the movement of the bearing with respect to the casing.

6. A device for grinding a portion of a crankshaft while the latter is rotated in an engine block, comprising a grinding wheel, a driven shaft connected to said grinding wheel and extending upwardly therefrom, a rotatable member containing an eccentrically disposed bearing surface which supports said shaft at one side of the rotative axis of the member, a casing engaging the outer surface of said rotatable member, an arm depending from the lower extremity of the casing, clamping means carried by said arm and engaging the lower surface of the crankshaft, an adjustable connection between the arm and the clamping means for adjusting said clamping means relative to said arm in such a manner as to adjust the position of the grinding wheel relative to the upper surface of the crankshaft and to hold the casing in rigid relationship with the crankshaft in such a manner that the casing reciprocates with the crankshaft when the latter is rotated, a guide rod extending above the casing, pivotal connecting means joining the casing and the guide rod to provide oscillatory movement of the casing relative to the guide rod, guide rollers engaging said guide rod for guiding the same in vertical reciprocating movement, said guide means being adapted for mounting on the engine block, a motor carried by the engine block, a flexible connection extending between said motor and said driven shaft for driving the same while the casing is in reciprocatory movement, a first manually operable means connected to the rotatable member for vertically moving the same relative to the casing, and a second manually operable means connected to the rotatable member for axially rotating the same relative to the casing to thereby laterally move the grinding wheel relative to the crankshaft.

ELMER A. FUGLIE.

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