

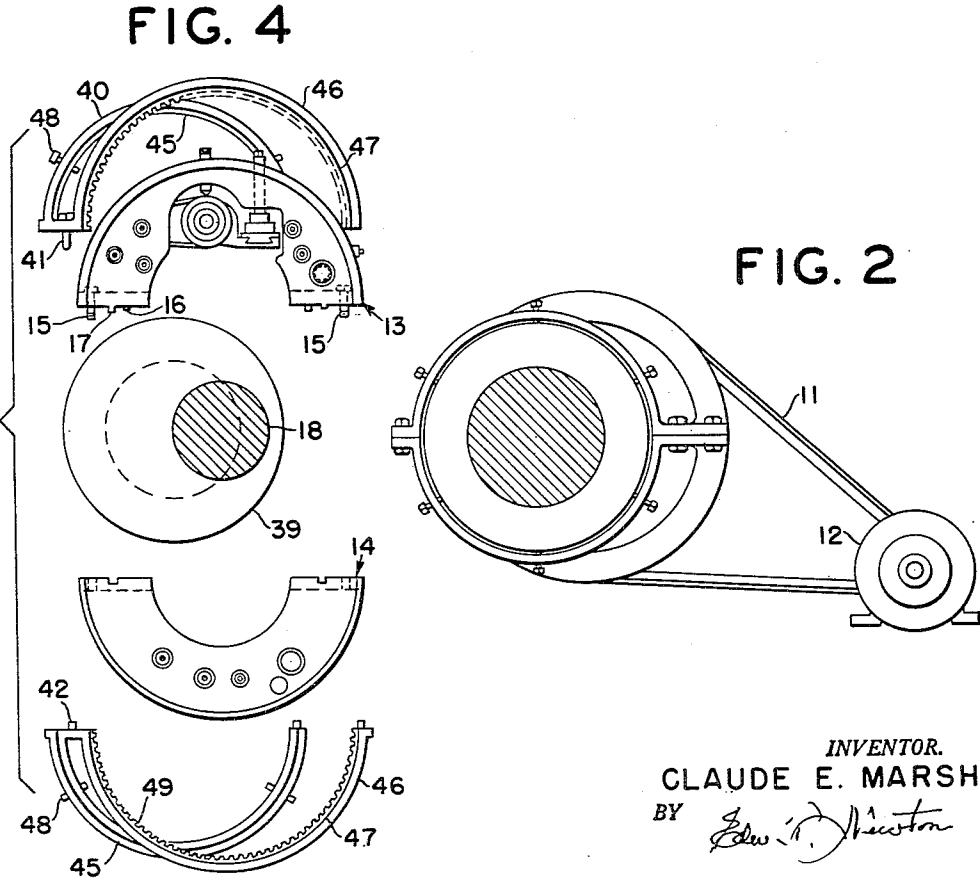
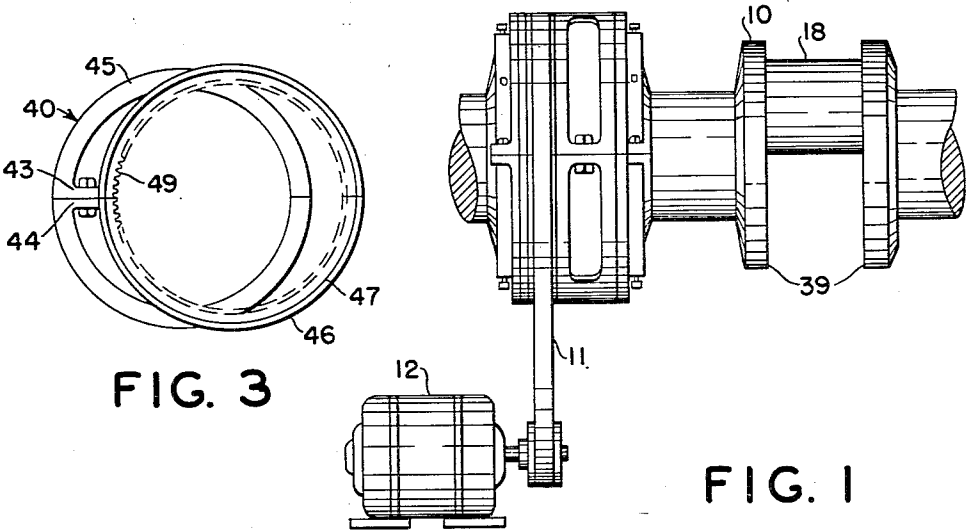
Jan. 4, 1955

C. E. MARSH
PORTABLE GRINDING MACHINE

2,698,505

Filed July 12, 1951

5 Sheets-Sheet 1



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Jan. 4, 1955

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PORTABLE GRINDING MACHINE

Filed July 12, 1951

5 Sheets-Sheet 2

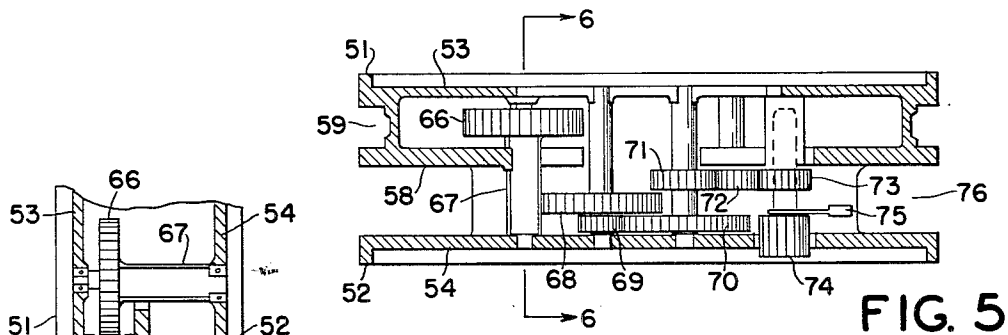


FIG. 5

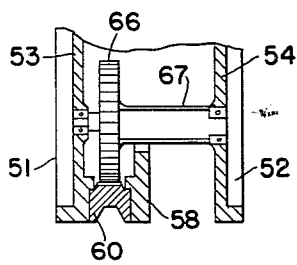


FIG. 6

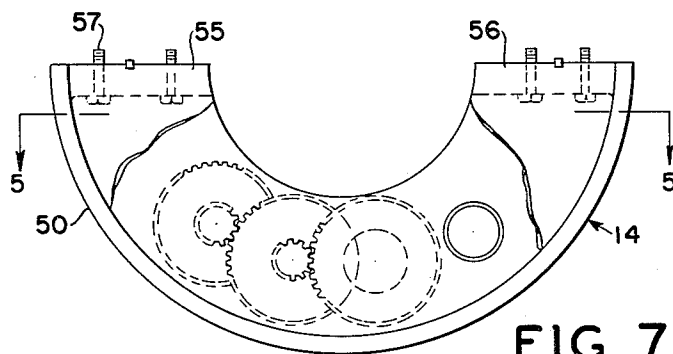


FIG. 7

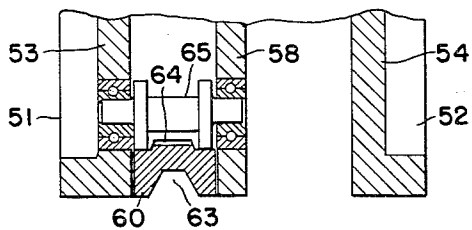


FIG. 8

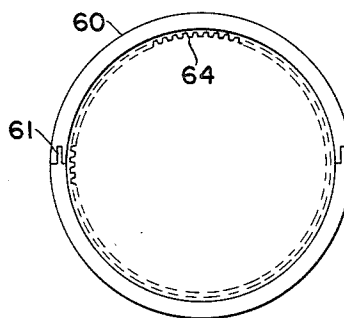


FIG. 9

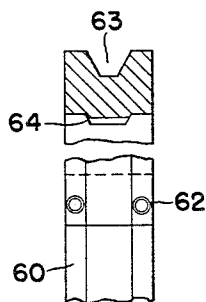


FIG. 10

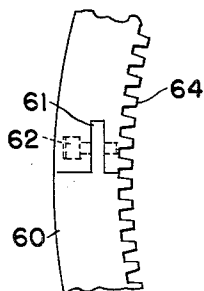


FIG. 11

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5 Sheets-Sheet 3

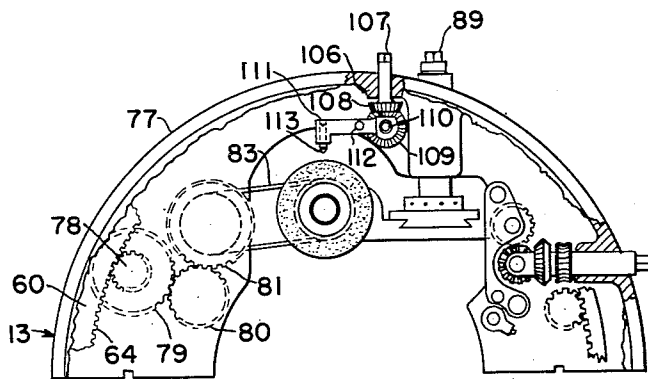


FIG. 12

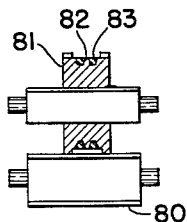


FIG. 13

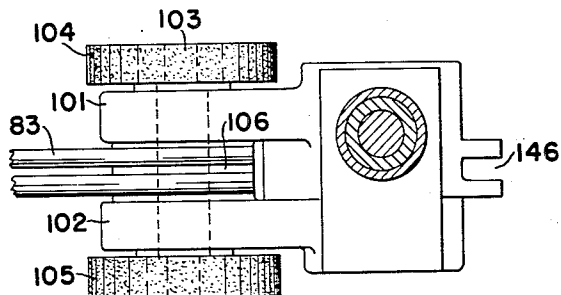


FIG. 14

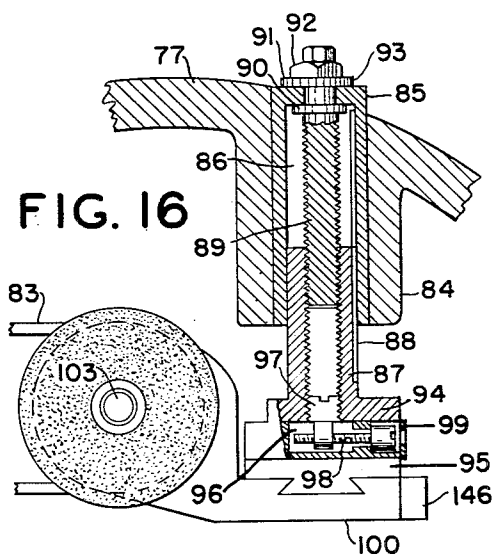


FIG. 16

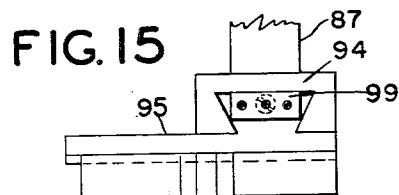


FIG. 15

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5 Sheets-Sheet 4

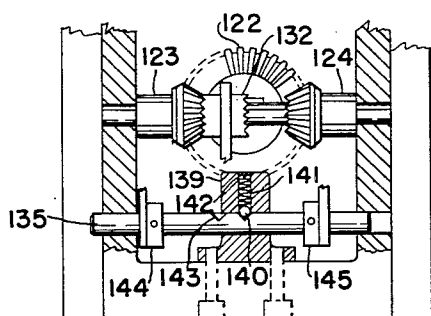


FIG. 17

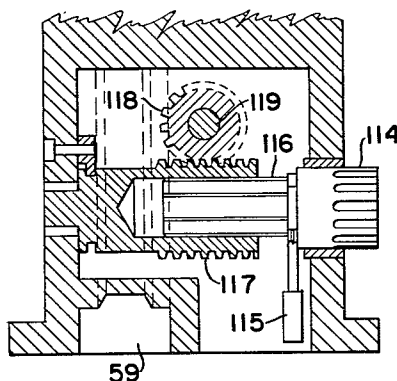


FIG. 18

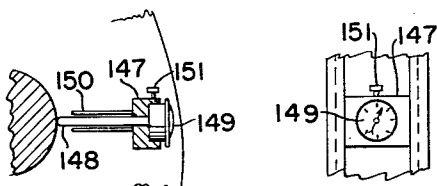


FIG. 27

FIG. 28

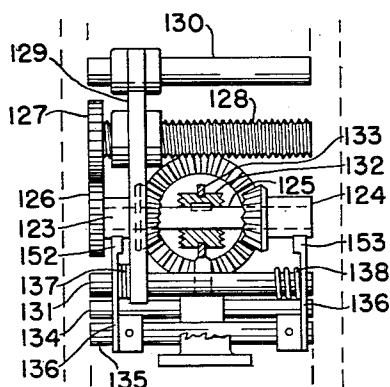


FIG. 19

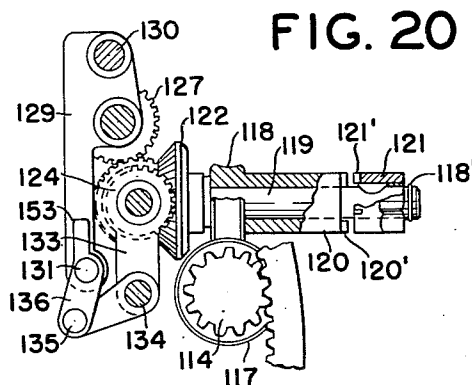


FIG. 20

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PORTABLE GRINDING MACHINE

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5 Sheets-Sheet 5

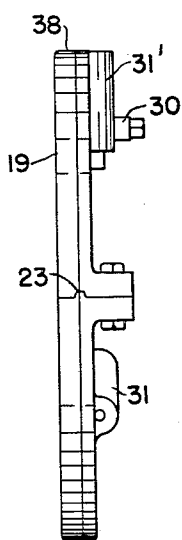


FIG. 21

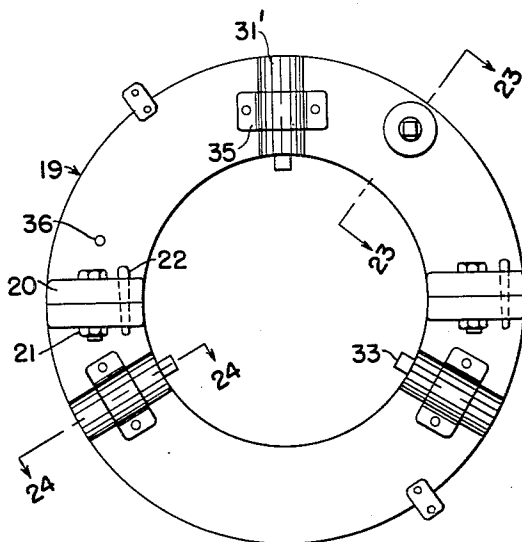


FIG. 22

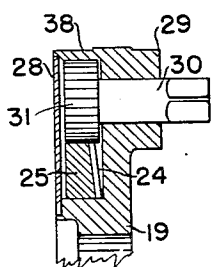


FIG. 23

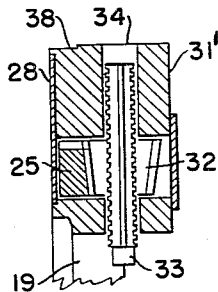


FIG. 24

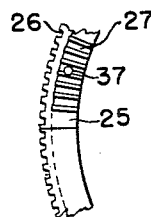


FIG. 25

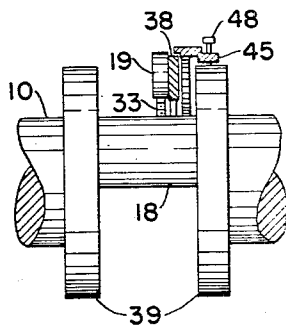


FIG. 26

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PORTABLE GRINDING MACHINE

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Herman F. Anderson, Kalamazoo, Mich.

Application July 12, 1951, Serial No. 236,289

8 Claims. (Cl. 51—241)

My invention pertains to portable grinding machines in general, but more in particular to a portable grinding machine for the crank pin journals of locomotives or other large engine crankshafts.

In the repair and maintenance of locomotives and other large engines, particularly with reference to the grinding of crankshafts therefor, it is well known that such a repair job is both tedious and expensive. The piston and rod assemblies must be removed, the main bearings disassembled, and the complete crankshaft taken from the engine and set up in an expensive turning lathe where the grinding takes place. So great is the cost of such an operation that often a single scored or badly worn pin found by an inspection crew is left in operation until its condition approaches the point of danger to the actual performance of the engine. It is apparent that the same procedure must be followed for the repair irrespective of whether a single pin or all of them are in need of grinding.

It is an object of my invention to provide a portable machine for grinding the journals of an engine crankshaft without the necessity of removing the crankshaft from the engine.

It is another object of the invention to provide a centering device by which the machine is mounted on the crankshaft to automatically provide the proper eccentricity between the main bearing pin and the rod pin.

Another object of the invention is to provide such a machine which is made in two semi-circular sections; each section including related components operable for grinding upon being joined around the pin of the crankshaft.

A further object of the invention is the provision of a novel grinding wheel assembly which is made not only to revolve slowly around the pin when grinding, but which is also made to move backwardly and forwardly along the longitudinal axis of the shaft. The assembly further includes provision for dressing the grinding wheels and also supplying the power for reciprocating them across the pin journal.

Another object of the invention is the provision of a combination V pulley and internal spur gear which is made to revolve in one direction while turning the joined sections of the grinding assembly in the opposite direction, thus putting the higher speeds on the internal grinding parts while permitting the heavy outer assembly to turn at a relatively low speed.

Other objects of the invention are: the provision for tightening or loosening the belts which rotate the grinding wheels, control of the depth of the grinding wheels and means for checking the depth of grinding in thousandths of an inch from any starting position.

With these and other objects in view, the invention consists of an arrangement of parts according to the accompanying drawing wherein like characters of reference designate corresponding parts throughout the drawing and wherein:

Fig. 1 is an elevational view of an embodiment of my invention in a portable crankshaft grinder, the same being shown assembled upon a portion of a crankshaft to be ground and arranged for use with an electric motor.

Fig. 2 is an end view of the assembly shown in Fig. 1.

Fig. 3 is a side view of what may be called a right-hand adapter, the two halves thereof being shown together as if encircling a portion of a crankshaft.

Fig. 4 is an exploded view illustrating the manner of assembly of the two-section device around a crankshaft.

Fig. 5 is a broken, cross-sectional view illustrating the

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mode of assembling a gear train in a general housing member.

Fig. 6 is a detail view taken substantially along the line 6—6 of Fig. 5.

Fig. 7 is a broken view of one of the two main sectional members showing the internally positioned gear train more in detail.

Fig. 8 is an enlarged detail view illustrating the manner of mounting the externally driven V belt.

Fig. 9 is a detailed view of the main drive gear and pulley.

Fig. 10 is a detail view illustrating the manner of joining the two semi-circular portions of the main drive gear.

Fig. 11 is another broken view illustrating the manner of locking the two semi-circular gear portions so as to form a true circular gear.

Fig. 12 is a broken view of the other of the two main sections of the general machine illustrated in Fig. 1, this view illustrating the mechanisms used in connection with the actual grinding.

Fig. 13 is a detail view of the combined pulley and belt arrangement used to rotate the grinding wheels.

Fig. 14 is a top view of the reciprocating grinding wheel bracket.

Fig. 15 is a detail view showing the rear side of the grinding wheel bracket.

Fig. 16 is an enlarged view illustrating the manner of setting the grinding wheels to a desired depth.

Fig. 17 is another detail view illustrating a portion of the reverse mechanism actuating the traverse of the grinding wheels across the pin journal.

Fig. 18 is a cross-sectional view illustrating the manner of sliding the main driving pinion of the grinding assembly into and out of a side wall of the housing proper in order to be entrained with the main drive gear positioned in one of the outer positioning adapters.

Fig. 19 is a front view of a reversing assembly which actuates the traverse of the grinding wheels across the pin journal.

Fig. 20 is a side view of the illustration shown in Fig. 19.

Fig. 21 is a side view of a centering device used in connection with the present invention to provide a concentric, radial position of the two primary adapters with respect to the offsets on the crankshafts to be ground.

Fig. 22 is a front view of the device illustrated in Fig. 21.

Fig. 23 is a cross-sectional view taken along line 23—23 of Fig. 22.

Fig. 24 is a cross-sectional view taken along line 24—24 of Fig. 22.

Fig. 25 is a broken view of a combination external spur and bevel gear used in the centering device.

Fig. 26 is a broken detailed view illustrating the mode of using the centering device to position the grinding assemblies of the present invention upon a crankshaft for a grinding operation.

Fig. 27 is a broken view illustrating a mode of checking the diameter of the pin during grinding.

Fig. 28 is a side view of the illustration of Fig. 27.

In the drawing, numeral 10 designates a portion of an engine crankshaft, one rod pin of which is being ground by use of a device made in accordance with the teachings of the present invention. The crankshaft 10 is representative of the type commonly used in locomotives, marine and power house work, and is shown without main bearings or connecting rod and piston assemblies. Engines of this type are provided with inspection plates which may be removed in order to inspect or remove the crankshaft. It is to be understood at the beginning of this specification, however, that removal of the entire crankshaft, as formerly required, is unnecessary with my invention. In fact, a single scored or slightly out-of-round pin may be ground in a few hours time where, according to the former practice, the shaft would be removed and require several days' time of a two-man crew for its repair.

In actual operation, as illustrated in Figs. 1 and 2, the device is powered by means of a belt 11 and an electric motor 12. The motor may be anchored to the repair shop floor or may be placed upon a stand in close proximity to the engine and secured in proper alignment for the belt to drive the mechanism as will now be described.

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In Fig. 4 of the drawing, it will be noted that the invention consists of two assemblies designated generally by the numerals 13 and 14. For convenience of reference one assembly 13 will be referred to throughout the description as the grinding assembly and the other 14 will be referred to as the gear train assembly. As seen in Fig. 4 these two assemblies are made semi-circular and are finally bolted together by means of bolts 15. Dowels 16 and keys 17 further assist in securing alignment of the two assemblies into a true and perfect circle around the pin 18 of the crankshaft 10.

The first problem presenting itself in the preparation of a machine of this type is that of securing concentric alignment between the grinding assembly and that of the pin to be ground. As a simple solution to this problem I have provided a device constructed according to the illustrations of Figs. 21 through 25 of the accompanying drawings. This device consists of a ring 19 made of two semi-circular segments having flanges 20 at their extremities so that the two halves may be bolted together in the manner shown. Bolts 21 and dowels 22 are placed through these flanges to secure the two halves together, and an aligning key 23 is positioned in the abutting ends of each half.

One side face of the ring 19 is provided with a recess 24 of such depth and diameter as to slidably receive a ring gear 25. The ring gear 25 is also made of two halves which are not tied together in any manner but are prevented from separating by being only slidably received in the recess 24 which is prepared for them. As shown in Fig. 25, the ring gear 25 is provided with spur gear teeth 26 on its peripheral face while one of its side faces is made into the form of a bevel gear 27. The ring gear 25 is held in its recess 24 by means of a cover plate 28 positioned over the recess and held by means of screws.

In Fig. 23, the cast ring 19 is shown as being provided with a raised boss 29 through which I have positioned the shaft 30 of a small pinion 31 enmeshed with the spur teeth of the ring gear 25. The outer end of the shaft is made square so that when a wrench is applied, the shaft may be rotated and thus rotate the ring gear 25 by the pinion 31.

In Figs. 21 and 22, the ring 19 is also provided with radially extending bosses 31'. These bosses are equally spaced circumferentially around the ring 19 and provide a means of constructing an assembly as shown in Fig. 24. Each boss 31' is slit transversely so that a small beveled pinion 32 might be enmeshed with the beveled teeth of the ring gear 25. Each pinion 32 is threaded internally to match the threads of a locating stud designated by the numeral 33. The locating stud is positioned through a hole 34 drilled radially through the boss 31' so that the stud 33 may be advanced toward or away from the center of the ring according to the direction of rotation of its pinion 32. Since all of the pinions 32 are simultaneously revolved by means of the ring gear 25, it is readily seen that all of the studs 33 may be moved in or out simultaneously by means of the shaft 30. In order to keep dirt and other foreign matter from collecting around the pinions 32, I have provided a sheet metal cover 35 which covers the slot prepared for inserting the beveled pinion 32.

In the ring 19, I have provided a locating hole 36 with a correspondingly positioned hole 37 in the ring gear 25. When removing the joined assembly from around a crankshaft pin, it will be necessary to align these two holes 36 and 37 so that the parting line of the split gear 25 will coincide with the diametrical parting line of the ring 19. Thus the two complete halves may be readily disassembled by removing the locking bolts 21. Around one peripheral side edge of the assembled ring is a turned surface 38 machined to a given dimension so that the grinding assemblies can be properly located.

To use the centering mechanism as described above, the two halves of the ring 19 are assembled loosely over the rod pin 18 of the crankshaft 10 and the locating studs brought to bear upon the pin by turning the shaft 30 in the proper direction of rotation. In actual practice it has been found that the pins position the ring sufficiently at right angles to the axis of the shaft; but, if it is so desired, a dial indicator or other measuring instrument may be used to check for proper alignment. As illustrated in Fig. 26, the ring 19 is positioned slightly away from the main flanges 39 of the crankshaft 10 with the machined surface 38 thereof facing the flange.

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It will be remembered that the main flanges of any crankshaft are concentric with each other throughout the length of the shaft, so my centering device may be used first upon one flange and then upon another in any given crankshaft.

Referring now to Figs. 3, 4 and 26, the following description will disclose how I have provided two parallel side gears, both concentrically aligned with the pin to be ground and which cooperate with the gear train assembly 14 and the grinding assembly 13. In Fig. 3 I have shown what I have termed an adapter, designated generally in the drawing by the numeral 40. As in the case of all the other components, this adapter is also made into halves held together by bolts 41 and positioning dowels 42. The complete adapter actually defines two eccentric or overlapping circles, the upper and lower halves being held rigidly together by means of the flanges 43 and 44 and by a web (not shown) placed at the point where the circles overlap. The inner ring 46 is provided with a machined shoulder 47 of such diameter as to fit snugly over the machined locating surface 38 provided on the ring 19. Thus, after positioning the centering device as formerly described, one of the adapters 40 is located around the centering device and the two halves thereof finally bolted together to form a perfect ring. The outer ring 45 of the adapter is provided with set screws 48 by means of which the adapter assembly is finally positioned on one of the flanges 39, as shown in Fig. 26. It will be remembered that the offset of the rod pin 18 of the crankshaft 10 will vary with difference makes of engines and therefore the adapters must be made accordingly. It will be remembered also that right and left hand adapters are necessary and each is mounted on opposing main flanges of the crankshaft by use of the centering device as formerly described. Unless such a centering device is used, positive concentricity between the adapters is not possible, hence the other components will not operate properly. After each adapter has been positioned on the respective flanges 39, the centering device is removed altogether from around the crank rod pin 18 so that the grinding assembly and the gear train assembly can be inserted. It will be noted further that the inner ring 46 on each adapter is provided with internal spur gear teeth 49.

Reference is now made to Figs. 6-11 for a description of the gear train assembly 14. This assembly consists of a housing 50 made of cast metal and machined to a perfect half-circle as shown. Flanges 51 and 52 are made to extend equidistantly from parallel side plates 53 and 54. Transverse flanges 55 and 56 are formed parallel to the diametrical center line of the housing to provide a means of connecting this assembly with that of the grinding assembly 13 by means of bolts 57.

Between the two side plates 53 and 54 is a web 58 which serves not only as an anchoring wall for several of the gear shaft ends but which also forms one side wall for a pulley groove. The pulley 60, as seen in Fig. 9, is made in two pieces and joined together to form a perfect circle. In the present instance I have provided tongues 61 on the ends of the lower half-section which are made to fit snugly into a corresponding groove provided on the upper half of the pulley. As illustrated in Figs. 10 and 11 the two half-sections of the pulley are finally secured together by placing screws 62 through the side rims of the pulley and through the tongues 61. The peripheral face of the pulley is provided with a V notch 63 corresponding in size and shape to a conventional V belt. The inner face of the pulley is provided with a set of spur gear teeth 64 serving to drive the entire gear train which will be subsequently described.

When assembling the pulley 60, it is simply slipped into the prepared groove 59 where it fits not too tightly so as to be permitted to revolve separately and apart from the housing 50. To reduce the sliding friction of this pulley, I have provided a construction as shown in Fig. 8. Spaced circumferentially around the housing 50 in several places I have provided rollers 65 rotatably journaled in the side wall 53 and the web 58. These rollers are made in the shape of a spool with the wheels or flanges thereof straddling the internal gear portion 64 of the pulley 60 and riding against the side edges of the inner face. Thus the pulley may roll freely upon these rollers 65 when the same is revolved by means of the driving belt 11 as shown in Fig. 1.

Fig. 6 will illustrate the manner of meshing the internal

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gear portion of the pulley 60 with the teeth of the first driving gear 66, and in Fig. 5 the transmission of power through the gear train follows in this order: from the first driving gear 66 through the pinion 67 to the driven gear 68, through driving gear 69 to driven gear 70, from driving gear 71 through the idler 72 to the driven gear 73. It will be noted that the shaft of this driven gear 73 is bored to receive the shaft of a final driving pinion 74. While the shaft of the final pinion 74 is slidably received in the bore provided in the shaft of the gear 73, it is keyed to the same so that it might rotate therewith. The purpose of such construction is to allow the final pinion 74 to be moved into and out of engagement with the internal driving gear on its corresponding adapter, otherwise the housing 50 could not be positioned between the two adapters which have been previously mounted upon the main flanges 39 of the crankshaft 10. It will be further noted that I have provided a manually operable clutch 75 consisting simply of a yoke encircling a portion of the shaft of gear 74 with an opening 76 provided in the housing 50 so the operator's fingers may be inserted for operation of the clutch. While not shown in detail, each gear shaft and roller shaft is anchored in ball bearings so that the entire mechanism may be as freely operable as possible. The directions of rotation of the initial driving pulley 60 and the final output pinion have been made the same so that when the assembly is placed in the adapters, the pulley will be made to rotate in the opposite direction. It is also highly important to note that the speed ratio between the driving pulley and the final output pinion 74 is extremely high, so that while the driving pulley 60 may be revolving at a relatively high rate of speed, the entire housing 50 is made to revolve slowly in the opposite direction. By providing such construction, perfect balance is maintained and the centrifugal force imparted to the working components and the housing itself is kept to a minimum.

For a description of the grinding assembly 13 reference is now made to Figs. 12 through 20 of the accompanying drawing. In Fig. 12, the assembly housing 77 consists of a metal casting machined into the general shape of that described for the gear train housing 50. The same pulley groove 59 is provided in the peripheral face of the housing 77 to receive the pulley 60. Also not shown in these assembly views are the rollers 65 which are circumferentially spaced around the housing and constructed in the manner illustrated in Fig. 8. The internal teeth 64 of the pulley 60 are enmeshed with the first gear 78 of a gear train arranged to rotate the grinding wheels which will be described later in the specification. This gear 78, in turn, rotates a driving gear 79 which, through an idler 80, rotates a pair of spaced gears 81 shown more clearly in Fig. 13. In this figure the gear 81 is shown as provided with a pair of V grooves 82 spaced between the teeth. The gear is keyed to its shaft yet permitted to slide longitudinally along its shaft while the teeth of both gears 80 and 81 still remain in mesh. Since the housing 77 is rotated in the opposite direction from that of the initial driving pulley 60, as formerly described, it is readily apparent that considerable speed is imparted to the final driving gear 82 which imparts rotation to the grinding wheels by means of connecting belts 83.

The adjustable grinding wheel and support bracket consists of an arrangement of parts illustrated in Figs. 14, 15 and 16. Through a prepared boss 84 positioned on the housing 77 I have extended a tight-fitting bushing 85 having an internal bore 86 adapted to receive a slidable standard 87 keyed to the bushing 85 by a key 88 to prevent rotation. The standard 87 is also threaded internally to receive a threaded adjusting stud 89. The stud 89 is provided with a flange 90 arranged to receive the thrust in one direction while a suitable washer 91 and lock nut 92 receive the thrust in the other direction. The peripheral face of the washer is provided with machined indices 93 which may be brought into alignment with a positioning index (not shown) on the upper face of the bushing 85. The upper end of the stud 89 is made hexagonal in the present instance so that by applying a wrench to the same, the stud may be turned in either direction of rotation to raise or lower the standard 87. The washer 91 is rigidly affixed to the stud for the alignment of the indices to indicate given increments of raising or lowering.

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At the lower end of the standard 87 I have provided a flange 94 supporting a longitudinal feed slide bar 95 which is dovetailed on the top side in the manner illustrated in Fig. 15. In the lower end of the internally threaded standard 87 I have positioned a threaded stud 97 with the lower portion thereof extended into slot 96 in the dovetail of the slide bar 95. The lower portion of this stud 97 is threaded transversely to receive an adjusting screw 98, the head of which is recessed into the side of the slide bar 95 and covered with a stop plate 99. The screw 98 is actually a slotted hollow-head cap screw which may be actuated by a wrench extended through an opening provided in the housing 77. This construction permits the tightening or loosening of the driving belts 83 which rotate the grinding wheels.

The base of the longitudinal slide bar 95 is also dovetailed into the wheel frame 100 to permit transverse movement of the wheels across the pin journal as will be described later. The frame is provided with two spaced brackets 101 and 102 which support the grinding wheel shaft 103. As shown in Fig. 14, two grinding wheels 104 and 105 are used, one positioned on each end of the shaft 103. Between the spaced bosses 101 and 102 I have provided a double pulley 106 which is keyed to the shaft 103 and arranged to receive the belts 83. Thus the entire base 100 may be moved transversely in the housing 77 by means of the dovetailed slide bar 95 as described, moving the rotating grinding wheels 104 and 105 across the pin journal for grinding. Since the driving gear 81 of the gear train is free to slide along its shaft, the belts 83 will be held in the proper driving alignment.

In order to keep the grinding wheels properly dressed, I have provided an arrangement illustrated in Fig. 12. Positioned through a boss 106 provided on the housing 77, I have placed a shaft 107 having its upper end prepared to receive a wrench. The lower end of the shaft 107 is provided with a bevel gear 108 having the teeth thereof entrained with the teeth of another bevel gear 109. This latter gear 109 is fixed to a transversely positioned threaded shaft 110 which is threadedly extended through the rear end of a diamond support bracket 111. To keep the support bracket 111 from revolving when the threaded shaft is rotated, I have provided a guide rod 112 having its ends fixed in the side walls of the housing 77 and upon which the bracket may slide longitudinally. The forward end of the support bracket is provided with a diamond pointed stud threaded through the bracket 111 with the end 113 carrying the dressing diamond protruding from the lower side of the bracket and positioned just above the grinding wheels. Thus, the bracket may be moved transversely across the housing and the threaded stud 110 by rotating the shaft 107. Since the diamond pointed stud 113 is threaded through the forward end of the support bracket 111, the diamond may be brought into or out of engagement with the wheels for dressing. The procedure for rotating the wheels for dressing will be more clearly brought out in the description of the gear train to follow.

As pointed out at the beginning of the specification, it is one of the objects of the present invention to include mechanism for moving the grinding wheels transversely across the rod pin they are intended to grind. As can be seen from the construction of the invention thus far, it is necessary that the mechanism for grinding be included in a space slightly narrower than the actual width of the pin journal, hence a single grinding wheel having the full-face width of the journal could not be used. It is necessary, therefore, that either one or a pair of wheels be used and that transverse movement be imparted to the wheels to cover the full-face width of the journal. In the present construction I have provided a pair of wheels, the overall width of which is much narrower than the face width of the journal; but, I have also provided mechanisms which permit the wheels to move across the journal for grinding. In the present instance, one of the wheels will move to a point adjacent one of the flanges 39 of the crankshaft 10, then the travel will reverse and the entire assembly will be moved toward the other flange where the opposite wheel is permitted to grind the pin at a point adjacent its corresponding flange. Thus the grinding by the two wheels actually overlaps near the center of the pin giving the effect of having been ground by a single wheel of the full-pin width. Such mechanism will

be more clearly understood by reference to Figs. 17 through 20 of the accompanying drawing.

In Fig. 18, I have provided a driving pinion 114 adapted for engagement with the internal ring gear on one of the adapters formerly described. This pinion 114 is also provided with a manually operable clutch 115 so that the gear may be moved into and out of engagement with the adapter gear, much in the same manner as the construction of the pinion 74 described in the gear train assembly of Fig. 5. The shaft 116 of this pinion is fitted with a spline and slidably inserted into a bore provided in a worm 117. This worm 117 is engaged by a worm gear 118, the shaft of which is extended and rotatably mounted in a prepared boss on the housing 77. The length of the worm shaft is bored to slidably receive the shaft 119 of a bevel gear 122 as shown in Fig. 20. On the opposite end of shaft 119 I have placed a nut 121 keyed to the shaft but permitted to move longitudinally thereon. On the inner face of the nut I have prepared serrations 121' matching serrations 120' formed on the end of the worm gear shaft 118. To prevent the nut 121 from slipping off the end of the shaft 119 I have provided a retaining ring 118'.

Now it becomes apparent that as long as the nut 121 is engaged with the end of the worm shaft, that is, with the serrations of these two components matched, power from the initial rotating gear 114 will be transmitted through the worm gear 118 to the nut 121, and finally to the shaft 119 which rotates the driving bevel gear 122. To disconnect the power feed where the above movements may be made manually, it is only necessary to pull the nut outwardly and disengage the clutch face thereof from that of the end of the wormshaft. Since the nut 121 is keyed to the shaft, the shaft may now be rotated by means of a wrench applied to the nut.

On the forward end of the shaft 119, in front of the worm gear 118 is a bevel gear 122 simultaneously rotating two bevel gears 123 and 124. These gears are mounted so as to rotate freely upon a shaft 125 yet are simultaneously rotated in opposite directions by means of the bevel driving gear 122. At the left hand end of the shaft 125 is a small spur gear 126 fixed to the shaft so as to rotate therewith. This spur gear 126 is enmeshed with a similar spur gear 127 fixed to rotate with another shaft 128. It will be noted that this last mentioned shaft 128 is provided with a common screw thread, the purpose of which will be subsequently described. Engaged by the threads of the shaft 128 is a driving bar 129 the upper end of which is slidably mounted on a stationary guide rod 130 and the lower end slidably mounted over another guide rod 131. Disposed centrally of the length of the shaft 125 is a clutch member 132 keyed to the shaft for rotation therewith but permitted to slide longitudinally thereon. Both side faces of the clutch member 132 are provided with serrations, matching serrations formed on the face of each of the opposed beveled gears 123 and 124. It now becomes apparent that if the clutch 132 were moved to the left where its serrations would mesh with those of the bevel gear 123, the shaft 125 is connected to the threaded shaft 128 by the gears 126 and 127, the threaded shaft 128 would be turned in a corresponding direction. Now if the clutch 132 were suddenly moved to become enmeshed with the serrations of the opposite gear 124, the shaft 125, and consequently the shaft 128, will be rotated in the opposite direction.

To accomplish such reverse movement, I have provided a yoke member 133 placed in a prepared groove in the clutch member 132, the lower end of which is rigidly mounted upon a guide rod 134, the ends of which are permitted to slide longitudinally in the side walls of the housing 77. Also arranged to be slidably journaled in the side walls of the housing member 77 is a forward rod 135. Rigidly affixed to the three rods 131, 134 and 135 are two triangularly shaped brackets 136, one positioned near each of the ends of the aforementioned shafts. As seen in Fig. 19, between these brackets and the driving bar 129 I have placed compression springs 137 and 138. The forward rod 135 is shown in Fig. 17 as being extended through a block 139 fastened to the inside of the housing by means of screws. The boss is drilled, as shown, to receive a small steel ball 140 urged against the shaft 135 by means of a compression spring 141 and an adjustable set screw 142. The forward shaft 135 is provided with V notches 143 which are spaced apart for a distance equal to the distance required to transfer the clutch 132 from engagement with one of the bevel gears to engage-

ment with the other. In order to provide minute adjustment for this distance I have provided set collars 144 and 145 on the lower or forward rod 135.

From the above description the manner of reversing the traverse of the driving bar 129 can be seen. When the bar 129 reaches one end of its travel, as in Fig. 19, the lower end strikes the compression spring 137 and begins to compress it. It will be remembered that when the clutch 132 is engaged with one of the bevel gears 123 or 124, and the machine is in operation, it takes some little force to disengage the clutch and move it into engagement with the other gear. Also, there is a point between the two bevel gears 123 and 124 where the clutch would be running idle if there were no outside force, such as a spring, to move the clutch across this neutral position. The actual engagement of the clutch on one gear holds the clutch tightly until sufficient pressure can be built up in the springs to finally disengage the clutch and move it across this neutral position into engagement with the opposite gear. It will be noted further that on the upper ends of the connecting brackets 136 I have provided contact arms 152 and 153 which receive the final thrust of the bar 129 at a point nearer the thrust point of the shaft 128, thus relieving the tendency of the bar to be cocked or to otherwise bind upon the threaded shaft 128. When the bar 129 finally engages the contact arm 152, there is sufficient pressure built up in the spring 137 to snap the clutch across the neutral position. The three shafts 131, 134 and 135 are all moved simultaneously since they are all connected together by means of the brackets 136. The force on the forward shaft 135 causes the ball 140 to be forced out of one V notch and slipped into the other. Note that the action of the ball and spring tend to give the shaft a final, sudden push which assists in securely engaging the teeth of the clutch against one of the bevel gears. In other words, the ball and spring mechanism tends to hold all of the shafts together with the clutch in one position until sufficient pressure is built up in one of the springs 137 or 138, at which point the bar 129 has moved sufficiently across the shaft 128 to move the clutch across its neutral position. If such construction were not provided, it is apparent that the clutch would simply be moved out of engagement with one of the gears and simply rotate in a neutral position.

Referring again to Fig. 14, it may be seen that the wheel frame here is provided with a yoke 146 suitable for slidably receiving the front edge of the driving bar 129 so that the driving bar, in its reciprocatory movement may drive the grinding wheels backward and forward across the pin journal.

In the present construction it is necessary that the driving bar be moved to one side in order to reach the adjusting screw 98 described elsewhere for applying tension to the grinding wheel driving pulleys 83. It now becomes apparent that the above described movement of the driving bar can be accomplished in the same fashion by engaging the clutch of the manual control and applying a wrench to the prepared nut 121.

If desired, the construction according to that of Figs. 27 and 28 may be used which employs the use of a dial indicator with a gaging anvil contacting the pin diameter. In these figures a gaging block 147 is placed transversely across the diametral axis of the housing assemblies and a recess is bored into the outer face of the block at exactly 90 degrees from this axis. The counterbore is then bored centrally to receive the gaging stem 148 of a conventional dial indicator 149. Since the gaging stem is some four or five inches long in the present instance, I have prepared a guide tube 150 arranged to receive the stem to prevent any except longitudinal movement thereof. In this manner a true and accurate reading of the gage may be obtained. The gage may be left in the gage block 147 and held in position by means of set screws 151; or, if desired, the entire indicator and stem may be inserted into the block only periodically as a check. To use the instrument, it is necessary to take an original reading before the grinding begins, any subsequent readings being checked with the original to note the amount of material removed by grinding.

As a brief resume of a complete operation of the device, let it be assumed that the device is being used to grind a pin journal of a diesel engine. It will be remembered that it has been heretofore necessary to remove the entire crankshaft for this operation, a procedure which has not only been extremely expensive but tedious since all of the

adjustments of the other portions of the crankshaft must be interfered with.

With the present invention a single repairman can prepare the device for operation in a few hours' time. By removing the side plates from the engine, the crankshaft is exposed sufficiently to remove the rod and piston assembly. The oil, of course, is drained and the usual precautions are taken for prohibiting the steel grindings from dropping into the engine where they might prove dangerous. By using the centering device, the two side adapters are quickly aligned over the side flanges of the crankshaft. The two gear train driving pinions 74 and 114 are moved inwardly by their respective clutches to permit the two main assemblies of the gear train assembly 13 and the grinding assembly to be positioned in operative position on the adapters. The main drive pulley 60, together with its driving belt 11, is then fitted over the two locked assemblies. As before stated, any sort of prime mover may be employed such as an electric motor as illustrated in the drawings. By applying a wrench to the shaft 89, the grinding wheels are lowered until they touch the face of the pin journal. After moving the driving pinions 74 and 114 into engaged positions with their respective adapter gears, the machine is ready for operation. If the dial indicator mechanism is to be used to calculate the depth of grinding, an original reading is noted with subsequent depths subtracted at each periodic checking. An original reading may also be taken on the calibrated washer 91 with subsequent readings taken directly from the indices on the washer.

Since the depth of a single traverse of the grinding wheels is approximately 4 or 5 thousandths of an inch, it is apparent that even the worst scored pin or journal may be reground in a matter of minutes.

An unique feature of the present invention is that the grinding wheels may be power rotated while being dressed by the diamond dressing tool. To accomplish this, the driving pinion 74 (Fig. 5) is moved out of engagement with the internal spur gear teeth of its respective adapter by use of the clutch 75. It will be remembered that this pinion is used to rotate the entire machine in order to revolve the grinding wheels around the pin journal. By breaking this geared connection, the machine is made to remain stationary without affecting any of the other assemblies since the gear train for rotating the grinding wheels themselves are operated by the revolving pulley 60.

Dis-assembly of the unit follows in the reverse order with the halves of the several assemblies being separated and removed from the shaft. Thus a pin is re-ground without removing the shaft from the engine and without disturbing the bearing settings of the other portions of the shaft.

While the device contains precision made parts it is actually simple in its construction and so arranged that it may be operated by any novice or apprentice. It is comparatively light in weight and since each assembly is made in halves, it may be assembled and disassembled by a single operator.

Other modifications or changes in the form of construction may also be made without departing from the scope of my invention as defined in the following claims.

I claim:

1. In a portable grinding machine, separable complementary housings adapted to be removably connected together about a crankshaft pin, an adapter adapted to be connected to the flanges of a crankshaft pin for centering said connected housings for rotation about said pin, means connected to one of said housings for rotating said connected housings about said pin, a grinding assembly in another of said housings, said assembly comprising a grinding wheel adjustably arranged for grinding engagement with said crankshaft pin, and means for rotating said grinding wheel to grind the entire periphery of said crankshaft pin as said connected housings are revolved about said pin.

2. In a portable grinding machine, complementary housings adapted to be connected together about a crankshaft pin, an adapter adapted to be connected to the flanges of a crankshaft pin for centering said connected housings for rotation about said pin, means connected to one of said housings for rotating said connected housings about said pin, a grinding assembly in said housings, said assembly comprising a grinding wheel adjustably arranged for grinding engagement with said crankshaft pin, said grinding wheel being mounted for rotation about its

axis and for reciprocating movement longitudinally of the entire length of said crankshaft pin, and means for simultaneously rotating said grinding wheel and moving it longitudinally of said crankshaft pin to grind said pin as said connected housings are revolved about said pin.

3. In a portable grinding machine, complementary housings adapted to be connected together about a crankshaft pin, gearing in one of said housings for rotating said connected housings about said pin, a grinding assembly in another of said housings, said assembly comprising a grinding wheel shaft, a plurality of grinding wheels arranged on said grinding wheel shaft for grinding engagement with said crankshaft pin, said grinding wheels being mounted for rotation about their axes and for reciprocating movement longitudinally of said crankshaft pin, and means for simultaneously rotating said grinding wheels and moving them longitudinally of the entire length of said crankshaft pin to grind said pin as said connected housings are revolved about said pin.

4. In a portable grinding machine, complementary housings adapted to be connected together about a crankshaft pin, gearing in one of said housings for rotating said connected housings about said pin, grinding assembly in said housings, said assembly comprising a plurality of grinding wheels adjustably arranged for grinding engagement with said crankshaft pin, said grinding wheels being mounted for rotation about their axes and for overlapping reciprocating movement longitudinally the entire length of said crankshaft pin, and means for simultaneously rotating said grinding wheels and moving them longitudinally of said crankshaft pin to grind said pin as said connected housings are revolved about said pin.

5. In a portable grinding machine, complementary housings adapted to be connected together about a crankshaft pin, an adapter for centering said connected housings for rotation about said pin, said housings being provided with a driving pulley formed of complementary segments and mounted for rotation on said housings, an internal gear on said driving pulley, reduction gearing in one of said housings selectively engageable with said internal gear for rotating said connected housings, a grinding assembly in the other of said housings, said assembly comprising a grinding wheel adjustably arranged for grinding engagement with said crankshaft pin, said grinding wheel being mounted for rotation about its axis and for reciprocating movement longitudinally of said crankshaft pin, and means selectively engageable with said internal gear for simultaneously rotating said grinding wheels and moving them longitudinally of said crankshaft pin to grind said pin as said connected housings are revolved about said pin by rotation of said driving pulley.

6. In a portable grinding machine, complementary housings adapted to be connected together about a crankshaft pin, an adapter for centering said connected housings for rotation about said pin, said housings being provided with a ring shaped driving pulley formed of complementary segments and mounted for rotation on said connected housings, means for rotating said driving pulley, a driving gear on said driving pulley, reduction gearing in one of said housings selectively engageable with said driving gear for rotating said connected housings, a grinding assembly in said housings, said assembly comprising a grinding wheel adjustably arranged for grinding engagement with said crankshaft pin, said grinding wheel being mounted for rotation about its axis and for reciprocating movement longitudinally of said crankshaft pin, and means operatively connected to said driving gear for simultaneously rotating said grinding wheel and moving it longitudinally of said crankshaft pin to grind said pin as said connected housings are revolved about said pin by rotation of said driving pulley.

7. In a portable grinding machine, complementary housings adapted to be connected together about a crankshaft pin, an adapter for centering said connected housings for rotation about said pin, said housings being provided with a circumferential groove, a ring shaped driving pulley formed of complementary segments and mounted for rotation in said groove, means for rotating said driving pulley, an internal gear on said driving pulley, reduction gearing in one of said housings selectively engageable with said internal gear for rotating said connected housings, a grinding assembly in another of said housings, said assembly comprising a plurality of grinding wheels adjustably arranged for grinding engagement

with said crankshaft pin, said grinding wheels being mounted for rotation about their axes and for reciprocating movement longitudinally of said crankshaft pin, and means operatively connected to said internal gear for simultaneously rotating said grinding wheels and moving them longitudinally of said crankshaft pin to grind said pin as said connected housings are revolved about said pin by rotation of said driving pulley.

8. In a portable grinding machine, two complementary semi-circular housings adapted to be aligned and connected together in a circle about a crankshaft pin, a plurality of adapters for centering said connected housings for rotation about said pin, said housings being provided with a circumferential groove, a ring shaped driving pulley formed of complementary semi-circular segments and mounted for rotation in said groove, means for rotating said driving pulley, an internal gear on said driving pulley, reduction gearing in one of said housings selectively engageable with said internal gear for rotating said connected housings, a grinding assembly in the other of said housings, said assembly comprising a plurality of grinding wheels adjustably arranged for grinding engagement with said crankshaft pin, said grinding wheels being mounted for rotation about their axes and for reciprocating movement longitudinally of said crankshaft pin, and means operatively connected to said internal gear for simultaneously rotating said grinding wheels and moving them longitudinally of said crankshaft pin to

grind said pin as said connected housings are revolved about said pin by rotation of said driving pulley.

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