July 15, 1941. L. F. KLINE 2,249,388

CRANKPIN GRINDING APPARATUS

Filed June 6, 1940 4 Sheets-Sheet 1

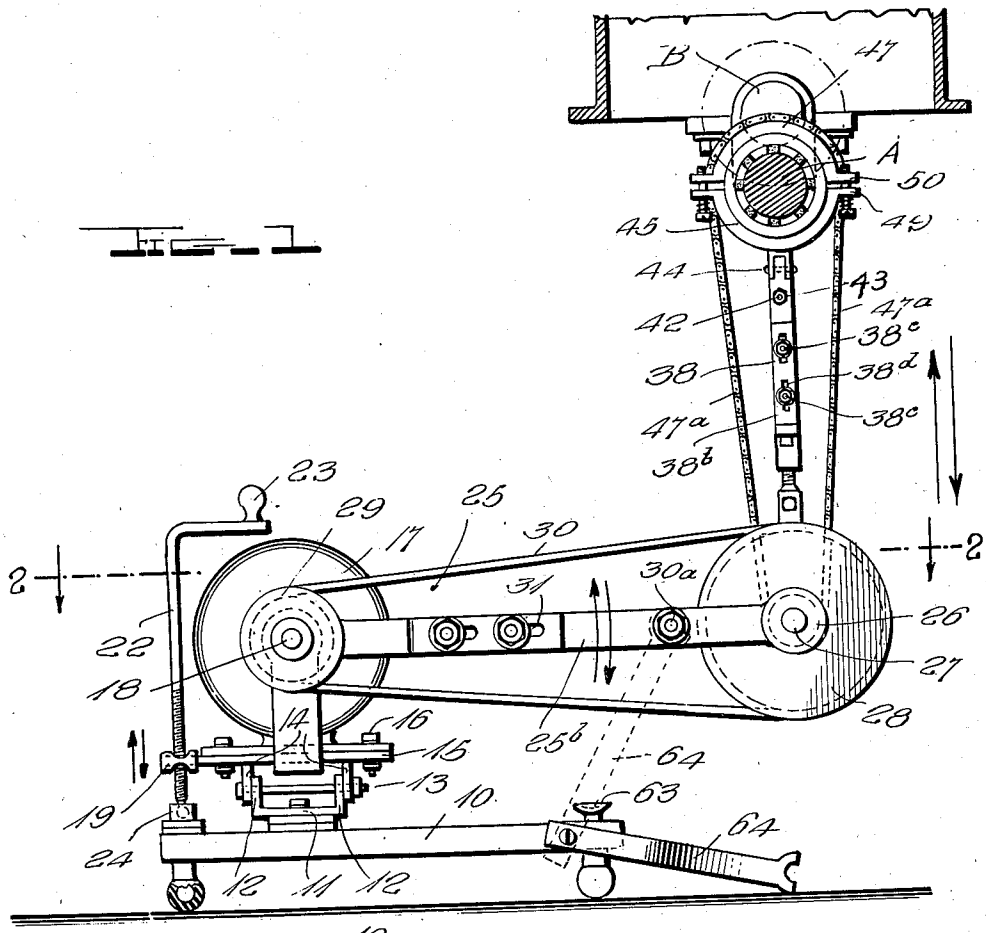


FIG. 1

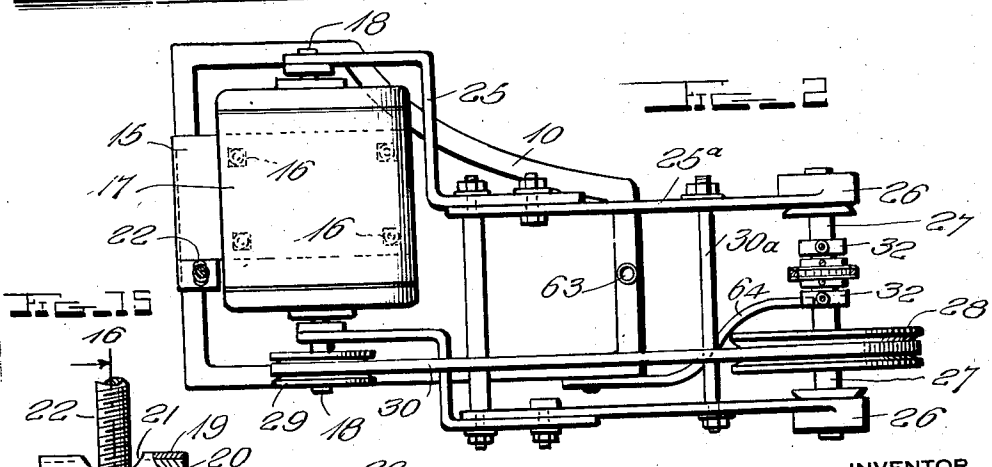


FIG. 2

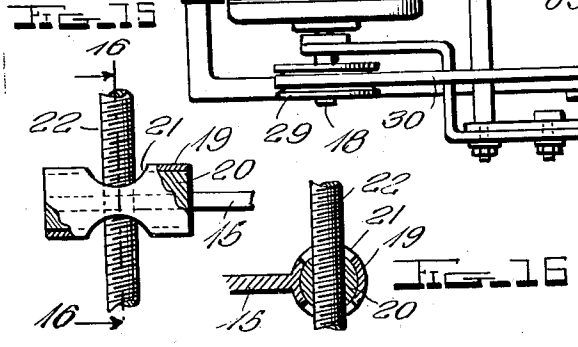


FIG. 15 FIG. 16

INVENTOR
L. F. Kline,
BY Horace C. Chandlee
ATTORNEY

July 15, 1941. L. F. KLINE 2,249,388

CRANKPIN GRINDING APPARATUS

Filed June 6, 1940 4 Sheets-Sheet 2

FIG. 3

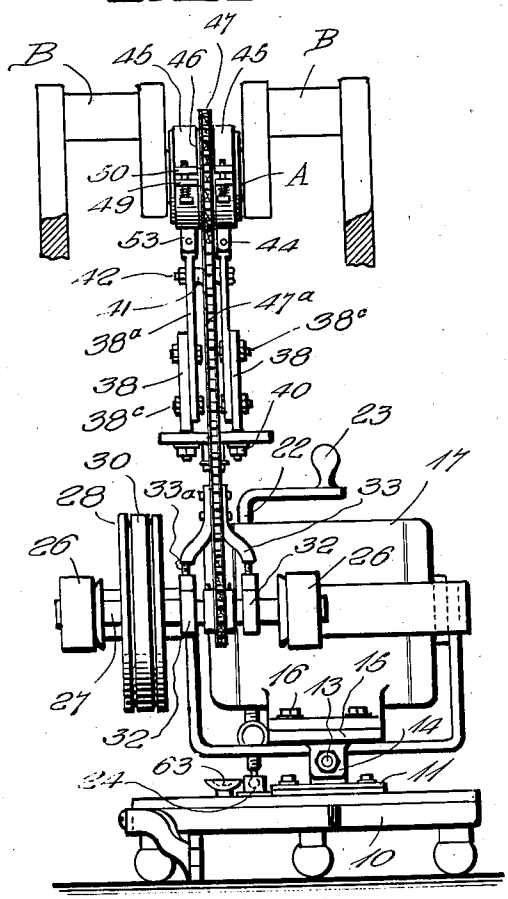
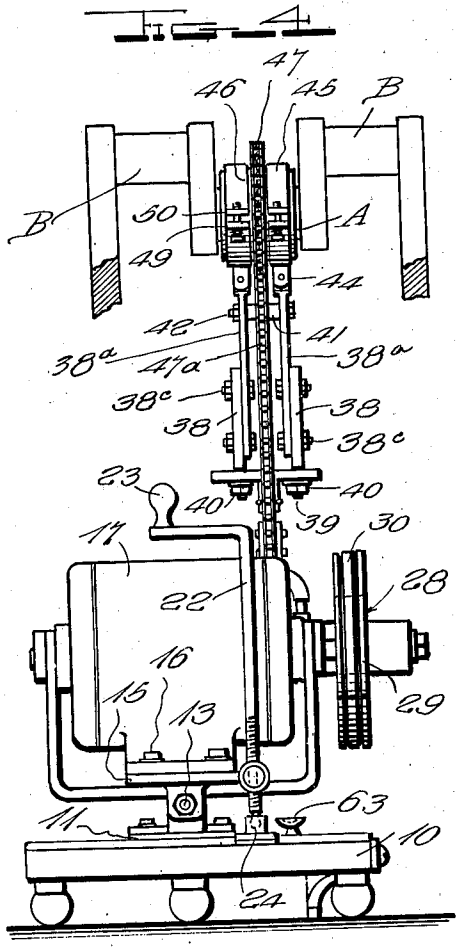


FIG. 4



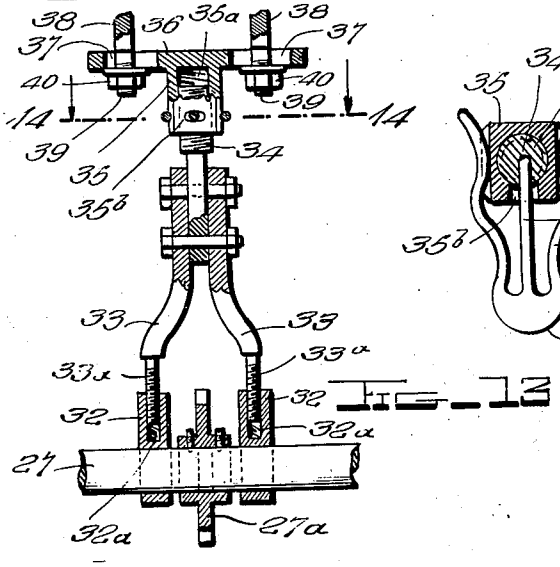


FIG. 13

FIG. 14

INVENTOR
L. F. Kline,
BY Horace C. Chandler
ATTORNEY

July 15, 1941. L. F. KLINE 2,249,388

CRANKPIN GRINDING APPARATUS

Filed June 6, 1940 4 Sheets-Sheet 3

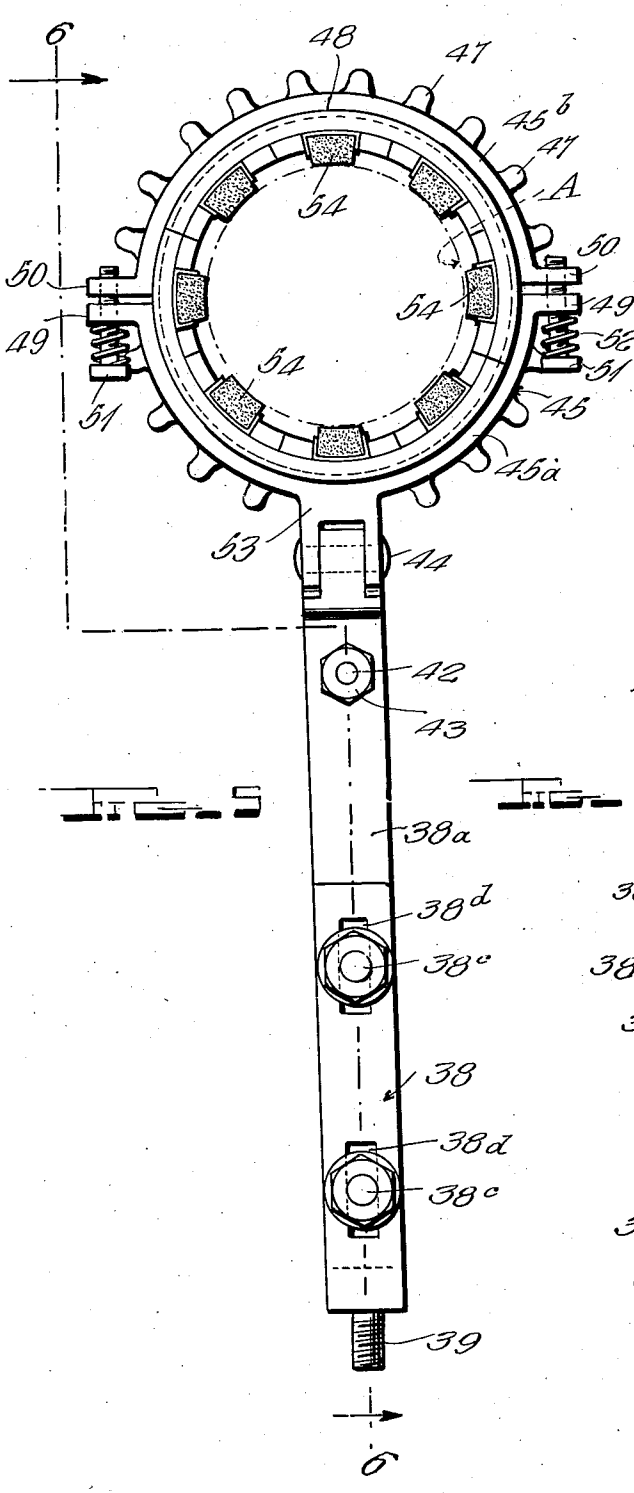


FIG. 5

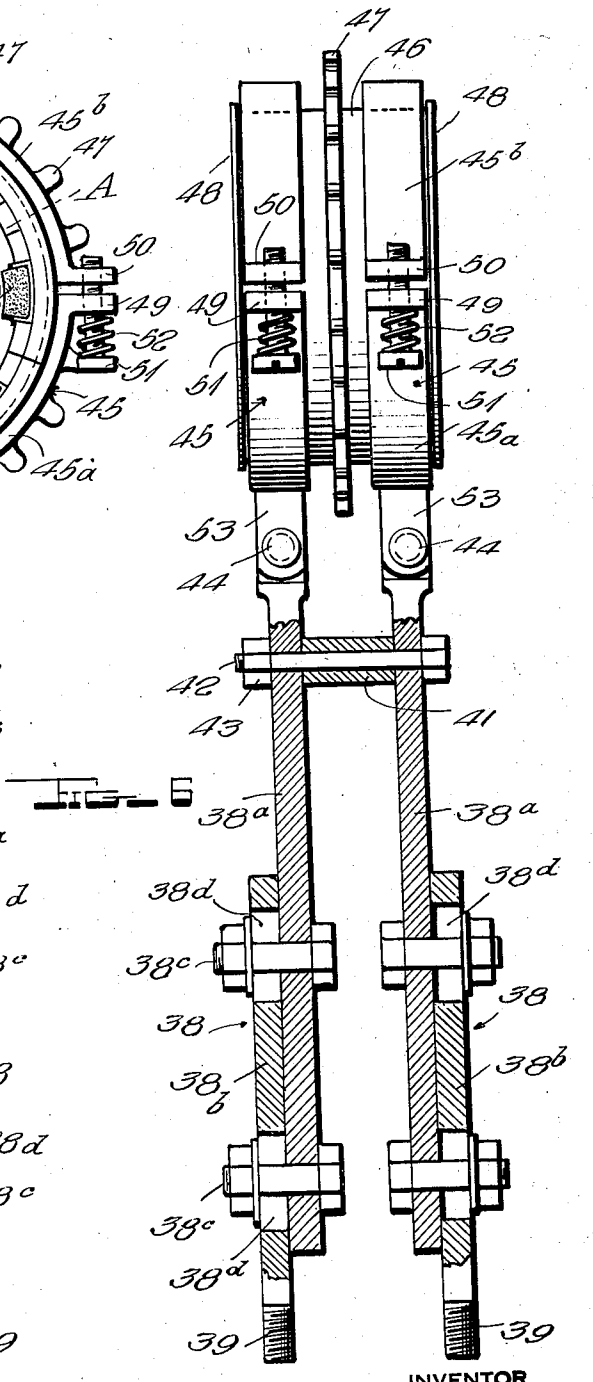


FIG. 6

INVENTOR

L. F. Kline,

BY Horace C. Chandler

ATTORNEY

July 15, 1941. L. F. KLINE 2,249,388

CRANKPIN GRINDING APPARATUS

Filed June 6, 1940 4 Sheets-Sheet 4

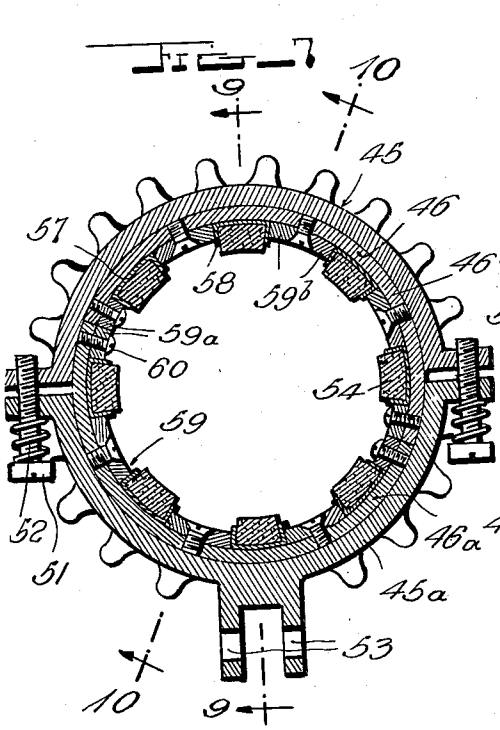


FIG. 7

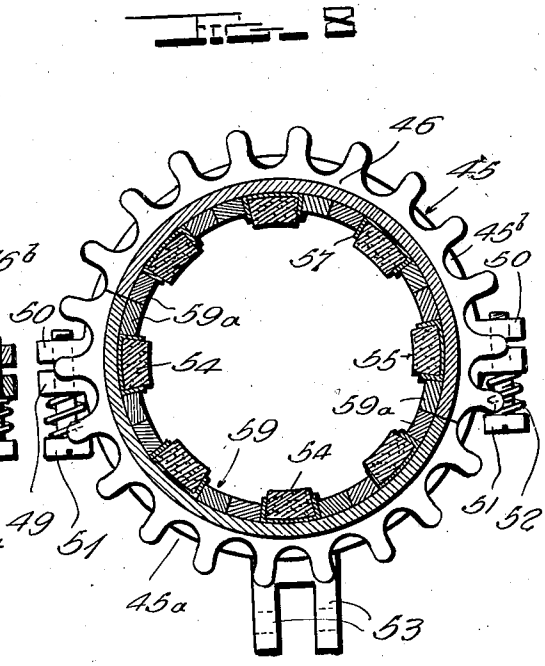


FIG. 8

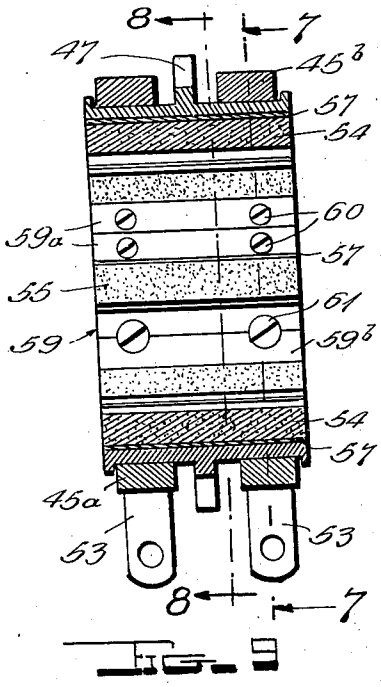


FIG. 9

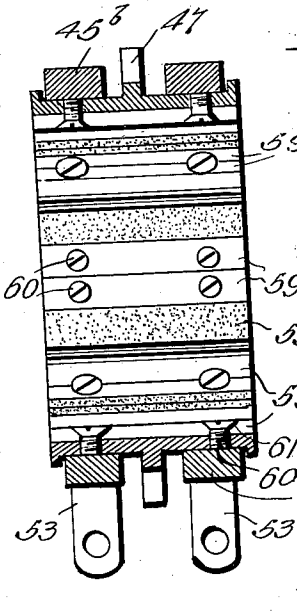


FIG. 10

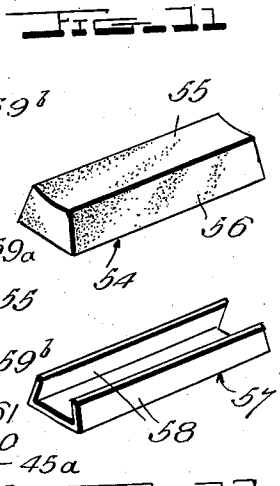


FIG. 11

FIG. 12

INVENTOR
L. F. Kline,
BY Horace C. Chandlee
ATTORNEY

Patented July 15, 1941

2,249,388

UNITED STATES PATENT OFFICE

2,249,388

CRANKPIN GRINDING APPARATUS

Leon F. Kline, Franklin, W. Va.

Application June 6, 1940, Serial No. 339,189

8 Claims. (Cl. 51—73)

This invention relates to grinding machines and more particularly to machines for grinding or truing the crankpins of a crankshaft such as is used in the reciprocating engine of a motor vehicle.

One object of the present invention is to provide a grinding machine for the purpose mentioned which may be successfully used without the necessity of removing from the motor vehicle the motor or its crankshaft.

Another object is to provide a grinding machine of the type stated having a grinding head which is so arranged as to discontinue automatically its grinding action when the crankpin has been ground to a predetermined degree.

The invention possesses other objects and advantages some of which will be set forth in the preferred form of the invention which will be described in the following specifications and illustrated in the accompanying drawings in which—

Fig. 1 is a side elevation of a grinding machine constructed in accordance with the present invention and showing the same operatively connected with a crankpin to be ground,

Fig. 2 is a section on the line 2—2 of Fig. 1,

Fig. 3 is a front view of the device in operative position,

Fig. 4 is a rear view of the same,

Fig. 5 is a side elevation of a grinding head and support embodied in the invention,

Fig. 6 is a sectional view on the line 6—6 of Fig. 5,

Fig. 7 is a vertical transverse section through the grinding head and one of its surrounding straps, taken on the line 7—7 of Fig. 9,

Fig. 8 is a similar view taken on the line 8—8 of Fig. 9,

Fig. 9 is a vertical longitudinal section through the grinding head with its surrounding straps, taken on the line 9—9 of Fig. 7,

Fig. 10 is a sectional view on the line 10—10 of Fig. 7,

Fig. 11 is a perspective view of a grinding unit forming a portion of the grinding head,

Fig. 12 is a perspective view of a supporting clip for the grinding unit,

Fig. 13 is an enlarged detail view, partly in section and partly in elevation,

Fig. 14 is a section on the line 14—14 of Fig. 13,

Fig. 15 is an enlarged detail, partly in section, illustrating certain parts of the mechanism for rocking the motor, and

Fig. 16 is a section on the line 16—16 of Fig. 15.

The present invention, as hereinbefore mentioned, is particularly designed for grinding and truing the crankpins of crankshafts such as used in internal combustion engines of motor vehicles, although, as will be understood, it may be used for grinding other cylindrical surfaces.

In the drawings, 10 designates a supporting base connected to the upper face of which is a bracket 11 having upstanding ears 12 pivoted to which, by means of a bolt 13, are the depending ears 14 of a plate 15. The plate 15 is adapted to rock in a vertical plane and secured to its upper face, as by bolts 16, is an electric motor 17 having a shaft 18 the ends of which protrude beyond the ends of the motor casing. Connected to a rear edge portion of the plate 15 and extending laterally therefrom is a tubular lug 19, the bore of which extends at a right angle to the motor shaft 18, and loosely positioned within this bore is a cylindrical nut 20. The wall of the tubular lug 19 is cut away at the central portions of its upper and lower faces as at 21 in line with the threaded opening of the nut 20. Threaded through the nut 20 and passing through the cutaway portions of the tubular lug 19 is an adjusting crank 22 the upper end of which is provided with a handle 23 while its lower end is secured to the base 10 by a ball and socket joint 24 the ball portion of which is formed upon the lower end of the crank 22. It will be seen that the plate 15 carrying the motor 17 may be rocked on the bolt 13 by turning the crank 22 in either direction. Pivotally supported on the protruding ends of the shaft 18 are the inner ends of a vertically rockable frame 25 in the outer ends of which are bearings 26 of any suitable type which support a rotatable countershaft 27 attached to which is a pulley 28 driven from a similar pulley 29 on the motor shaft by a belt 30. It will be noted, by reference to Figures 1 and 2, that the side members 25a and 25b of the rockable frame 25 are each formed in two sections connected by the well-known screw and slot arrangement shown at 31, so that the length of these side members may be varied for adjustment of the belt 30. The side members 25a and 25b of the frame 25 are held in proper spaced relation by means of a spacer bar 30a.

As shown in Fig. 13, a pair of disks 32 are loosely mounted in spaced relation on the shaft 27, which disks are provided with screw-threaded recesses 32a which adjustably receive the lower threaded ends 33a of legs 33 having a threaded lug 34 secured to and extending beyond their upper ends. The lug 34 is threaded into a socket 35a formed in a stud 35 centrally positioned on the under side of a bar 36, said stud having a

slot 35b through its wall adapted to register with a recess 34a in the lug 34. At opposite sides of the stud 35, the bar 36 is provided with longitudinal slots 37. Resting upon the bar 36 directly above each of the slots 37 is an end of one of a pair of supporting rods indicated generally at 38 each of which has a threaded lug 39 extending from its lower end and through one of the slots 37. The rods 38 are each formed of upper sections 38a and lower sections 38b adjustably connected together by bolts 38c passing through slots 38d in the lower sections as shown. By this means, the rods may be lengthened or shortened. The lugs 39 are provided with nuts 40 by means of which the rods 38 may be clamped to the bar 36 after they have been adjusted to proper spaced relation. The upper end portions of the rods 38 are maintained in proper spaced relation by means of a spacing sleeve 41 of suitable length positioned therebetween. A bolt 42 having a nut 43 threaded thereon passes through the rods 38 and through the sleeve 41 to hold the rods in contact with the sleeve.

Loosely connected to the upper end of each of the supporting rods 38 by means of a pivot 44 is an annular strap 45 each of which loosely encircles an end portion of a tubular grinding head 46 adapted to be rotated by a sprocket 47 formed integral therewith intermediate its ends, which latter are provided with circumscribing flanges 48. These flanges serve to hold the straps 45 against lateral movement beyond the ends of the grinding head 46. The sprocket 47 is rotated by a chain 47a leading from a sprocket 27a secured on the shaft 27 between disks 32. The tension of the chain 47a may be adjusted by lengthening or shortening the supporting rods 38.

Each strap 45 includes lower and upper semicircular sections 45a and 45b, respectively. The ends of these sections are provided with radially projecting ears, those of the lower sections being designated at 49 and those of the upper sections being designated at 50. Headed adjusting screws 51 pass loosely through perforations in the ears 49 and are threaded into perforations in the ears 50. Coil springs 52 surround the screws 51 between their heads and the adjacent ears 49 which springs tend to draw the sections of the straps together. Projecting radially downward from the center of each of the lower sections 45a of the straps 45 is a lug 53 which is bifurcated to receive the upper end of one of the supporting rods 38. The pivots 44 pass through the upper ends of the connecting rods and through the furcations of the lugs 53 whereby to provide a pivotal connection between the rods 38 and the straps 45.

As shown in Figs. 7 and 8 of the drawings, the grinding head 46 is formed of two semicircular sections 46a and 46b, as a result of which construction the grinding head may be readily placed in surrounding relation to a crankpin A of a shaft B where its sections are held against displacement by their surrounding straps 45. Removably mounted on the inner faces of the sections of the grinding head and extending axially thereacross are spaced elongated grinding units 54 formed of abrasive material. The inner faces of these grinding units are correspondingly concaved, as at 55, according to the curvature to which the surface of the crankpin is to be finished, and their side walls 56 converge towards their concaved surfaces to a slight degree so as to fit snugly within metal supporting clips 57 having converging side walls 58. A series of the supporting clips, with the grinding units therein, are mounted on the inner face of each of the semi-circular sections of the grinding head, the clips being held in spaced relation by means of clamping strips designated in general at 59. At the end of the inner face of each semicircular section of the grinding head a single clamping strip 59a is attached by means of screws 60 which pass therethrough. The strips 59a serve as abutments for the endmost of the supporting clips while the intermediate clamping strips 59b are arranged in pairs, each pair being held in position by screws 61 which pass between the strips and into the sections 46a and 46b. The confronting edges of the strips of each pair are recessed as at 62 to receive the screws 61, and the upper ends of the recesses are flared to receive the beveled heads of said screws. As a result of this arrangement, the strips 59a will be forced apart upon tightening of the screws 61, so as to exert a clamping action upon the supporting clips 57, which will result in holding the grinding units firmly in position.

In Fig. 14, 62 designates a gauge clip including a head 62a from which projects a pair of outer legs 62b and a central leg 62c. The use of this gauge clip will be described later herein as will also the use of a brace-supporting socket 63 shown in Fig. 4.

Pivoted to the base 10 is a brace 64 which is used as a support for the frame 25 and the attached parts when the device is not in use. At that time the brace is swung upwardly so as to engage beneath the spacing bar 30a.

When putting the present invention to use for grinding a crankpin in the engine of a motor vehicle, without first removing either the engine or its shaft, the lower section of the crankcase if first removed after which the connecting rods are disconnected from the crankpin to be ground, and the grinding head 46 is placed in surrounding relation to the crankpin. The sections 45a and 45b of the straps 45 are then placed around the grinding head where they are held by the screws 51 having the springs 52 thereon, after which the chain 47 is placed in position on the sprockets 46 and 27a. The parts as thus assembled are illustrated in Fig. 1.

Before the grinding operation takes place, it is necessary to make sure that the axis of the grinding head and that of the countershaft 27 are parallel. This is accomplished by turning the crank 22 so as to swing the plate 15 and the parts attached thereto in one direction or the other until the leg 62c of the gauge clip 62 may be passed freely through the slot 35a and into the recess 34a in the lug 34 while the legs 62b of the gauge clip are at the same time caused to engage opposite sides of the stud 35, as shown in Fig. 14. The gauge clip is then removed before the grinding operation takes place.

Grinding heads of different internal diameters and of different lengths may be used, according to the make of crankshaft to be ground. The internal diameter of the grinding head may be varied by placing a shim of suitable thickness beneath each of the supporting clips 57.

Due to the fact that the crankpin will be of greater diameter at the beginning of an operation than when the work is completed, the ends of the grinding head sections 46a and 46b will stand apart somewhat at the start, as will also the ears 49 and 50 on the sections of the straps 45. As the grinding operation progresses, the spring 52 will tend to draw the strap sections

together, as a result of which the grinding head sections will also be drawn together until their ends come into contact. This will cause a discontinuance of the movement of the grinding head sections toward each other.

In order to hold the grinding machine in a fixed position beneath the motor car, a suitable brace rod may be placed in position with one end resting in the socket **63** and with its other end engaging a suitable part of the under portion of the motor vehicle.

It has been found that best results are obtained by slowly rotating the crankshaft during the grinding operation. This may be accomplished in any desired manner, such as with the use of the starting motor or the hand crank. During this operation, the frame **25** will, of course, oscillate in a vertical plane which movement is possible due to the fact that its inner ends are pivotally supported on the ends of the shaft **18**, also due to the fact that the disks **32** are loosely mounted on the shaft **27**.

While the operation of this device has been described as taking place without removing from the motor vehicle either the engine or its shaft, it is to be understood that the invention may be successfully used when the engine is removed and turned upside down, also when the shaft is removed and mounted in a lathe.

What is claimed is:

1. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a rotatable shaft pivotally connected to the base, means for rotating said rotatable shaft, a support having an end pivotally connected to the rotatable shaft, circular straps pivotally connected with the other end of the support, grinding means rotatably mounted in said straps and adapted to be assembled in surrounding relation to a crankpin, and means operable by the rotatable shaft for rotating the grinding means.

2. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a rotatable countershaft pivotally connected to the base, means for rotating said shaft, disks loosely mounted on the shaft, a support having an end adjustably connected to said disks, straps pivotally connected to the other end of the support, grinding means rotatably mounted in said straps and adapted to be assembled in surrounding relation to a crankpin, and means operable by the rotatable shaft for rotating the grinding means.

3. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath the motor vehicle, a rotatable shaft pivotally connected to the base, means for rotating said rotatable shaft, a support having an end pivotally connected to the rotatable shaft, circular straps pivotally connected with the other end of the support, each of said straps comprising a pair of separable semi-circular sections having ears projecting radially from their ends, perforations through the ears of one of the sections of each pair, threaded perforations through the ears of the other of the sections of each pair, headed screws passing through the first-named perforations and threaded into the second-named perforations, a coil spring surrounding each of said screws and having an end engaging the screw head and an end engaging the adjacent ear, grinding means rotatably mounted in said straps, said grinding means comprising a pair of separable sections adapted to be assembled in surrounding relation to a crankpin, and means operable by the rotatable shaft for rotating the grinding means.

4. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a motor pivotally mounted on the base and having a shaft, means for rocking the motor on its pivot, a frame pivoted to the motor shaft and adapted to rock in a vertical plane, a countershaft rotatably mounted on the frame, means connecting the motor shaft and countershaft for driving the latter, a support pivotally connected to the countershaft, grinding means rotatably mounted on said support and adapted to be assembled in surrounding relation to the crankpin, a sprocket carried by the grinding means, a sprocket carried by the countershaft, and means connecting said sprockets for rotating the grinding means.

5. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a rotatable countershaft pivotally connected to the base, means for rotating said shaft, disks loosely mounted on the shaft, a support having an end adjustably connected to said disks, straps pivotally connected to the other end of the support, grinding means rotatably mounted in said straps, said grinding means comprising semi-cylindrical sections adapted to be assembled in surrounding relation to a crankpin, each of said sections having grinding units disposed axially in spaced relation upon its inner face, means for clamping the grinding units to the semi-cylindrical sections, and means operable by the countershaft for rotating the grinding means.

6. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a rotatable countershaft pivotally connected to the base, means for rotating said shaft, legs pivotally connected to said shaft, a longitudinally slotted bar adjustably connected to the legs, supporting rods carried by the said bar and having their lower ends mounted in said slots for adjustment toward and away from each other, said supporting rods comprising upper and lower sections connected together for longitudinal adjustment, straps pivotally connected to the other end of the support, grinding means rotatably mounted in said straps, said grinding means comprising semi-cylindrical sections adapted to be assembled in surrounding relation to a crankpin, each of said sections having grinding units disposed axially in spaced relation upon its inner face, means for clamping the grinding units to the semi-cylindrical sections, and means operable by the countershaft for rotating the grinding means.

7. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a rotatable countershaft pivotally connected to the base, means for rotating said shaft, disks loosely mounted on the shaft, legs adjustably connected to said disks, a threaded lug carried by said legs, a longitudinally slotted bar threadedly connected to the lug, supporting rods carried by said bar and having their lower ends mounted in said slots for ad-

justment toward and away from each other, said supporting rods comprising upper and lower sections connected together for longitudinal adjustment, straps pivotally connected to the other end of the support, grinding means rotatably mounted in said straps, said grinding means comprising semi-cylindrical sections adapted to be assembled in surrounding relation to a crankpin, each of said sections having grinding units disposed axially in spaced relation upon its inner face, means for clamping the grinding units to the semi-cylindrical sections, and means operable by the countershaft for rotating the grinding means.

8. An apparatus for grinding the crankpins of a motor vehicle crankshaft or the like, comprising a base adapted for positioning beneath a motor vehicle, a rotatable countershaft pivotally connected to the base, means for rotating said shaft, disks loosely mounted on the shaft, a support having an end adjustably connected to said disks, straps pivotally connected to the other end of the support, grinding means rotatably mounted in said straps, said grinding means comprising semi-cylindrical sections adapted to be assembled in surrounding relation to a crankpin, each of said sections having supporting clips disposed in spaced relation upon its inner surface, grinding means mounted in said clips, pairs of clamping strips positioned between certain of the supporting clips and adapted to be moved into clamping engagement with said clips, and screws threaded into said sections between the clamping strips of each pair, the under sides of the heads of said screws being beveled whereby tightening of said screws will spread the clamping strips into tight engagement with the supporting clips.

LEON F. KLINE.