Nov. 4, 1941. E. D. LA FLEUR 2,261,903

GRINDING MACHINE STEADY REST

Filed Aug. 15, 1940

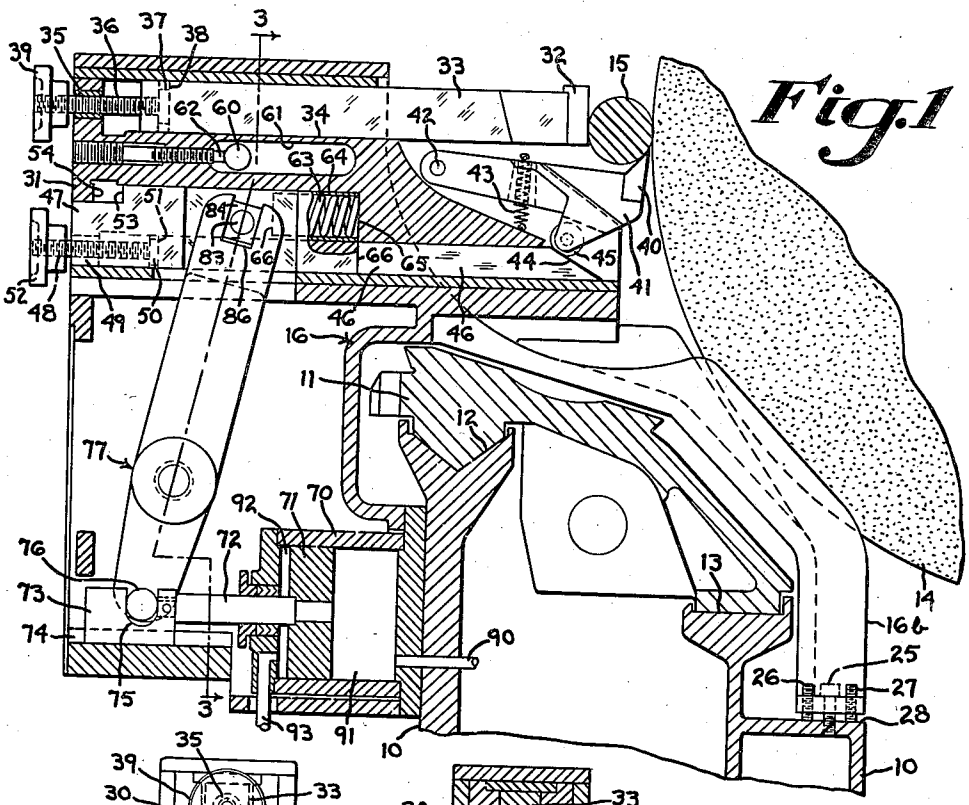
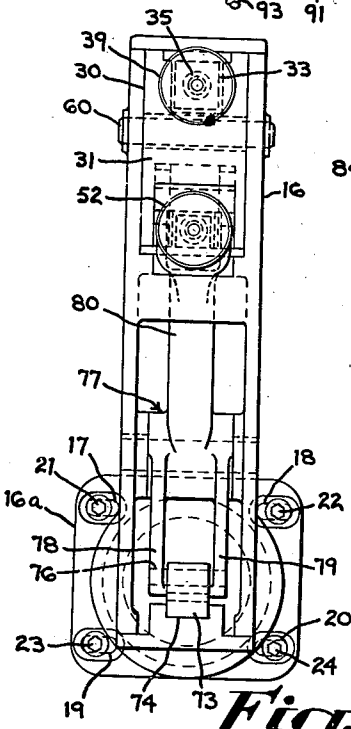


Fig. 1



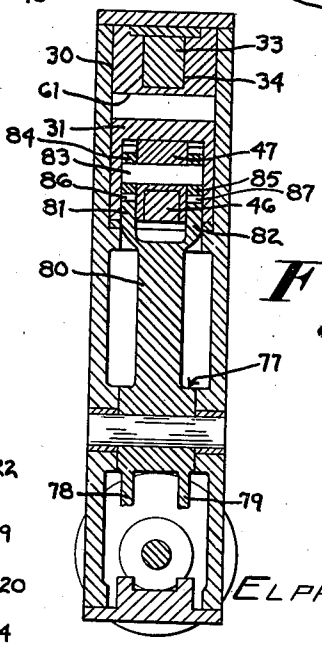


Fig. 3

Fig. 2

Inventor

ELPHEGE D. LA FLEUR

By Harold W. Eaton

Attorney

Patented Nov. 4, 1941

2,261,903

UNITED STATES PATENT OFFICE

2,261,903

GRINDING MACHINE STEADY REST

Elphege D. La Fleur, Lancaster, Mass., assignor to Norton Company, Worcester, Mass., a corporation of Massachusetts

Application August 15, 1940, Serial No. 352,687

9 Claims. (Cl. 51—238)

This invention relates to grinding machines, and more particularly to a steady rest for supporting and steadying a work piece during a grinding operation.

One object of the invention is to provide a simple and thoroughly practical steady rest construction. Another object of the invention is to provide a hydraulically operated steady rest which is compact in construction and simple in operation and action. Another object of the invention is to provide a hydraulically operated two-bearing shoe type steady rest which is arranged so that a horizontal shoe is first moved into operative supporting engagement with the work after which a lower shoe is moved into an operative position. A further object of the invention is to provide a two-bearing steady rest in which bearing shoes may be rapidly moved to an inoperative position to facilitate indexing of the table. A further object of the invention is to provide a rigid bridge type support for a steady rest which bridges the work supporting table and is adjustably fastened to the base on opposite sides of the work supporting table.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, all as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which is shown one of various possible embodiments of the mechanical features of the invention,

Fig. 1 is a cross-sectional view through the improved steady rest mounted in position on a cylindrical type grinding machine;

Fig. 2 is a front elevation of the improved steady rest; and

Fig. 3 is a vertical sectional view, taken approximately on the line 3—3 of Figure 1.

A steady rest has been illustrated as mounted on a grinding machine base 10. The base 10 supports a longitudinally reciprocable work supporting end table 11 which is supported on a V-way 12 and a flat way 13 formed on the base 10.

The improved steady rest is particularly adapted for use on a crankshaft grinding machine such as, for example, that shown in the U. S. patent to Herbert A. Silven, No. 2,151,666 dated March 21, 1939. In a machine of this type, the steady rest is ordinarily located in a fixed position opposite the operative face of the grinding wheel so that the steady rest shoes will support the pin 15 of a crankshaft to be ground. The steady rest shoes are arranged so that they may be withdrawn a considerable distance away from the work to an inoperative position so that after one pin has been ground, the table 11 supporting the crankshaft 15 may be traversed to position the next pin in an operative position.

In order to provide a rigid support for the steady rest shoes to steady the work piece against vibration during the grinding operation, a steady rest frame 16 is provided in the form of a bridge-shaped member 16 which straddles the work table 11. The frame 16 is provided with an enlarged rectangularly shaped portion 16a by means of which it is adjustably fixed on the front of the machine base 10. The rectangular portion 16a of the steady rest frame 16 is provided with a plurality of horizontally extending elongated slots 17, 18, 19 and 20. A plurality of clamping screws 21, 22, 23 and 24 pass through the elongated slots 17, 18, 19 and 20, respectively, and are screw threaded into the base 10 of the machine.

The bridge-shaped frame 16 has a rearwardly extending arm 16b which is fastened to a portion of the base 10 at the rear of the table 11 by means of a clamping screw 25. The clamping screw 25 passes through an elongated slot in the arm 16b and is screw threaded into the base 10. The pair of push screws 26 and 27 are screw threaded through a portion of the arm 16b and bear against a surface 28 on the base 10. By loosening the clamping screws 21, 22, 23, 24 and 25, the steady rest frame 16 may be adjusted longitudinally relative to the base 10, after which it may again be clamped in adjusted position. By means of the clamping screw 25 and the push screws 26 and 27, the arm 16b may be readily clamped in the desired manner to the base 10, thus forming a rigid support for the steady rest on opposite sides of the longitudinally movable table 11.

In the preferred form, the steady rest in order to adequately support and steady work pieces, such as the crankpins of an automobile crankshaft, is provided with a steady rest of the two-bearing shoe type in which the work is not only steadied at a point diametrically opposite the line of contact between the wheel and work but also at a point below the work axis and adjacent to the line of contact between the wheel and the work piece.

The steady rest frame 16 is provided with a rectangularly shaped, transversely extending aperture 30 which serves as a slideway for a

transversely movable slide 31. A horizontal work steadying shoe 32 is mounted on a horizontally movable supporting member 33 which slides within a rectangularly shaped slideway 34 formed in the upper portion of the transversely movable slide 31. The slide 31 is arranged to be moved transversely on the machine to provide a rapid positioning movement of the work steadying shoes in a manner to be hereinafter described. A nut and screw adjustment is provided between the slide 31 and the shoe supporting member 33 which comprises a nut 35 fixedly mounted in the slide 31. A screw 36 meshes with or engages the threads of the nut 35 and is provided with an enlarged head 37 which engages a notch 38 formed in the horizontally movable shoe supporting member 33. A manually operable adjusting knob 39 is mounted on the outer end of the screw 36 to facilitate adjustment of the shoe 32 relative to the transversely movable slide 31.

A second work steadying shoe 40 is fixedly mounted on a pivotally mounted shoe supporting arm 41 which is pivotally supported on the slide 31 by means of a stud 42. The shoe 40 is arranged to engage the work piece 15 at a point below the work axis and adjacent to the line of contact between the work piece 15 and the grinding wheel 14. A tension spring 43 interposed between the shoe supporting arm 41 and the slide 31 serves to exert a pressure normally tending to hold the shoe 40 in an inoperative position out of engagement with the work piece 15. The pivotally mounted shoe supporting arm 41 is provided so that it may be swung downwardly to an inoperative position so that the shoe 40 will clear the under side of the work piece when the slide 31 is withdrawn to an inoperative position. A cam 44 engaging a roller 45 which is supported on the shoe carrying member 41 serves to hold the shoe 40 in an operative position and also serves in a manner to be hereinafter described to facilitate rapid movement of the shoe 40 to an inoperative position. The cam 44 is formed on the end of a square-shaped rod 46 which is adjustably supported by a slide 47 slidably mounted within the lower portion of the slide 31. A nut and screw adjustment is provided between the slide 47 and the member 46 comprising a screw 48 which meshes with or engages a nut 49. The nut 49 is fixedly mounted within the slide member 47. The screw 48 is provided with an enlarged head 50 which engages a notch 51 formed in the cam supporting member 46. A manually operable knob 52 is mounted on the outer end of the screw 48 by means of which the cam 44 may be adjusted relative to the slide 47.

It is desirable that the shoe 40 be moved downwardly to an inoperative position before the slide 31 is moved to an inoperative position, that is, toward the left (Fig. 1). To facilitate such an operation, a lost motion is provided between the slide 47 and slide 31. The slide 47 serves as an actuating slide to move the main slide 31 toward and from an operative position.

When it is desired to move the steady rest shoes 32 and 40 from an operative position in engagement with the work to an inoperative position, the slide 47 is moved toward the left (Fig. 1). At the first of this movement no motion is transmitted to the slide 31. The movement of the slide 47 toward the left imparts a corresponding movement to the cam rod 46 which moves the cam 44 also toward the left so that the released tension of the spring 33 will swing the shoe carrying member 41 and the shoe 40 in a clockwise direction out of engagement with the work piece 15. The movement of the slide 47 toward the left continues to withdraw the cam 44 toward the left without imparting any withdrawal movement to the slide 31 until a shoulder 53 on the slide 47 engages a shoulder 54 formed on the slide 31. Continued movement of the slide 47 toward the left moves the slide 31 also toward the left to withdraw the horizontally movable work steadying shoe 32 together with the shoe 40 to an inoperative position so as to facilitate a traversing movement of the work table 11 to position the next portion of the work to be ground into an operative position relative to the grinding wheel 14.

An adjustable stop is provided to limit the forward movement of the slide 31 toward an operative position to facilitate locating the shoes 32 and 40 in the desired operating position. A stop rod 60 is fixedly supported in the opposite side plates of the frame 16. The rod 60 rides within an elongated clearance slot formed within the slide 31. An adjustable stop screw 62 which is screw threaded into the slide 31 is arranged in the path of the stop rod 60 and serves to limit the movement of the slide 31 toward an operative position, that is, toward the right (Fig. 1).

A yieldable cushion device is provided between the slides 31 and 47 which comprises a compression spring 63 which is contained within an aperture 64 formed within the slide 47. The spring 63 is interposed between a face 65 on the slide 31 and the bottom 66 of the aperture 64 in the slide 47. When it is desired to move the shoes 32 and 40 into an operative position, it is desirable first to move the shoe 32 in a horizontal direction into supporting engagement with the work before the shoe 40 is swung upwardly into an operative position.

The movement of the shoes 32 and 40 to an operative position is initiated by the movement of the slide 47 toward the right (Fig. 1). When the slide 47 starts its movement toward the right, the spring 63 engaging the slide 31 moves the slide 31 until the stop screw 62 engages the stop rod 60 which limits the forward advancing movement of the shoe 32, after which continued movement of the slide 47 compresses the spring 63 and moves the cam rod 46 a further distance toward the right so that the cam 44 engaging the roller 45 will swing the shoe carrying member 41 and the shoe 40 into an operative supporting engagement with the work piece 15. The forward advance of the slide 47, that is, its movement toward the right (Fig. 1) is limited by engagement of the end face 66 of the slide 47 with the face 65 of the slide 31.

When the slides 31 and 47 are in their forward or operative position, the shoes 32 and 40 may be further manually adjusted toward the work axis by manipulation of the manually adjustable knobs 39 and 52, respectively, so that the shoes 32 and 40 may be maintained in the desired operative engagement with the work piece 15 as the surface of the work piece is ground away by the grinding wheel 14.

To facilitate a rapid movement of the steady rest shoes 30 and 40 to and from an operative position, a fluid pressure mechanism is provided comprising a fluid pressure cylinder 70. A piston 71 is slidably mounted within the cylinder 70 and is connected to one end of a piston rod 72. The

other end of the piston rod 72 is connected to a slide block 73 which slides within a slideway 74 formed in the frame 16 of the steady rest. The slide block 73 is provided with a substantially U-shaped notch 75 in its upper surface which is engaged by a stud 76 which is in turn supported at the lower end of a rock arm 77. The lower end of the rock arm 77 is preferably yoke-shaped and comprises two downwardly extending arms 78 and 79 which support the stud 76 at their lower ends. The rock arm 77 is provided with an upwardly extending portion 80 which is yoke-shaped at its upper end and comprises the upwardly extending parallel arms 81 and 82 which are slidably connected to a stud 83 which is carried by the slide 47. A pair of slide blocks 84 and 85 are pivotally supported on opposite ends of the stud 83 and are slidably mounted in slots 86 and 87 formed in the yoked arms 81 and 82, respectively. This connection above described permits a free swinging movement of the arm 77 to transmit a sliding movement to the slide 31 to position the work steadying shoes 32 and 40 either in an operative or inoperative position.

When fluid under pressure is admitted from a suitable source of supply, such as from a fluid pump (not shown), through a pipe 90, into a cylinder chamber 91, it causes a movement of the piston 70 toward the left (Fig. 1) which imparts a clockwise rocking movement of the rock arm 77 which in turn moves the shoes 32 and 40 into an operative position. During this movement of the piston 71, fluid is exhausted from a cylinder chamber 92 through a pipe 93.

Similarly, when the direction of flow of fluid under pressure is reversed and fluid under pressure is admitted through the pipe 93 into the cylinder chamber 92, the piston 71 will be moved toward the right (Fig. 1), which movement is transmitted to rock the rock arm 77 in a counterclockwise direction. This movement of the rock arm 77 in a counterclockwise direction serves to move the slide 47 to first withdraw the shoe 40 to an inoperative position, after which the slide 31 is moved to withdraw both the shoe 40 and the shoe 32 in a horizontal direction to an inoperative position.

The operation of this improved steady rest will be readily apparent from the foregoing disclosure. Assuming all of the parts to have been previously adjusted, fluid under pressure is admitted through the pipe 90 to move the piston 71 together with the rock arm 77 and the other part of the rest into an operative position, as illustrated in Fig. 1, with the work shoes 32 and 40 in operative supporting engagement with the work piece 15. The grinding operation may then proceed by feeding the grinding wheel 14 toward the work axis during which grinding operation the shoes 32 and 40 are maintained in the desired position relative to the work piece 15 by manual actuation of the adjusting knobs 39 and 52, respectively. The adjustment of the knob 39 adjusts the shoe 32 relative to the slide 31 and actuation of the knob 52 adjusts the cam 44 relative to the slide 47.

After a grinding operation has been completed, the flow of fluid under pressure to the cylinder 70 is reversed so that fluid under pressure is admitted through the pipe 93 to move the piston 70 toward the right (Fig. 1), which movement transmits a corresponding movement to the piston rod 72 and the slide block 73. This movement serves to rock the rock arm 77 in a counterclockwise direction to move the slide 47 toward the left (Fig. 1). The released compression of the spring 63 serves to maintain the slide in its forward or operating position during the initial movement of the slide 47 toward the left. During this initial movement of the slide 47 toward the left, the cam 44 is also moved toward the left to allow the released tension of the spring 43 to rock the shoe supporting arm 41 in a clockwise direction so that the shoe 40 swings downwardly to a position where it will readily clear the under surface of the work piece 15 when it is withdrawn to an inoperative position. Continued movement of the slide 47 moves the shoulder 53 on the slide 47 into engagement with the shoulder 54 on the slide 31, after which continued movement of the slide 47 toward the left moves the slide 31 toward the left to withdraw both of the shoes 31 and 40 in a direction toward the left to an inoperative position to facilitate removal of the work piece 15 or the traversing of the work table to position another portion of the work piece in operative relation with the grinding wheel 14.

After a new work piece has been placed in operative position, or a new portion of the work piece 15 moved into an operative position, the direction of flow of fluid under pressure is reversed and fluid under pressure is admitted through the pipe 90 to move the piston 71 and the other parts of the steady rest into the position illustrated in Fig. 1. During the initial rocking movement of the rock arm 77 in a clockwise direction, due to the compression of the spring 63, the slide 47 carries the slide 31 into an operative position which is determined by the engagement of the stop screw 62 with the stop rod or stud 60, thus positioning the shoe 32 in an operative position. The continued movement of the slide 47 toward the right serves to compress the spring 63 which produces a further movement of the cam 44 toward the right into the position illustrated in Fig. 1 which transmits its motion through the roller 45 to rock the shoe carrying member 41 in a counterclockwise direction to raise the shoe 40 into operative supporting engagement with the work piece 15.

It will thus be seen that there has been provided by this invention apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a steady rest for grinding machines having a frame, a transversely movable slide within said frame, a movable work steadying shoe carried by said slide, a manually operable nut and screw to adjust said shoe relative to said slide, a second work steadying shoe pivotally supported on said slide, a movable cam on said frame to actuate said pivotally mounted shoe, and means operatively connected to move said slide to position the horizontal shoe in an operative position and thereafter to move said cam relative to said frame to shift said pivotally mounted shoe into an operative position.

2. In a steady rest for grinding machines having a frame, a transversely movable slide within said frame, a movable work steadying shoe carried by said slide, a manually operable nut and screw to adjust said shoe relative to said

slide, a second work steadying shoe pivotally supported on said slide, a slidable cam on said frame to actuate said pivotally mounted shoe, and means including a fluid pressure piston and cylinder which are operatively connected to move said slide to position the horizontal shoe in an operative position and thereafter to slide said cam relative to said frame to shift said pivotally mounted shoe into an operative position.

3. In a steady rest for grinding machines having a frame, a transversely movable slide on said frame, a stop adjustably to limit the movement of the slide in one direction, a horizontally movable work steadying shoe carried by said slide, a manually operable nut and screw to adjust said shoe relative to said slide, a second steady rest shoe pivotally supported on said slide, yieldable means to bias said latter shoe to an inoperative position, a movable cam on said frame to swing said second shoe into an operative position, actuating means operatively connected to move said slide and said cam, and connections between said actuating means and said slide and cam whereby the horizontal shoe is moved into an operative position after which the cam serves to swing the pivotally mounted shoe into an operative position.

4. In a steady rest for a grinding machine having a frame, a transversely movable slide on said frame, a stop adjustably to limit the movement of said slide in one direction, a horizontally movable work steadying shoe carried by said slide, a manually operable nut and screw to adjust said shoe relative to said slide, a second steady rest shoe pivotally supported on said slide, yieldable means to bias said latter shoe to an inoperative position, a movable cam on said frame to swing said second shoe into an operative position, a fluid operated piston and cylinder operatively connected to move said slide and said cam, and connections between said piston and cylinder and said slide and cam whereby the horizontal shoe is moved into operative position after which the cam serves to swing the pivotally mounted shoe into an operative position.

5. In a steady rest for grinding machines having a hollow frame, a slide movable within said frame, a horizontally movable work steadying shoe carried by said slide, a manually operable nut and screw to adjust said screw relative to said slide, a second work steadying shoe pivotally supported on said slide, a second slide which is slidably mounted relative to the first slide, a cam movable with the second slide which is arranged to engage the second shoe and swing it into an operative position in supporting engagement with the work piece at a point below the work axis and adjacent to the line of contact between the grinding wheel and work support, means including a nut and screw to adjust the position of the cam relative to the second slide, a lost motion connection between said slide, a compression spring interposed between said slides, and means operatively connected to move said second slide which through the first slide moves the horizontal shoe into operative supporting engagement with the work after which the spring is compressed as continued movement of the second slide moves the cam to swing the second shoe into an operative position.

6. In a steady rest for grinding machines having a hollow frame, a slide movable within said frame, a horizontally movable work steadying shoe carried by said slide, a manually operable nut and screw to adjust said screw relative to said slide, a second work steadying shoe pivotally supported on said slide, a second slide which is slidably mounted relative to the first slide, a cam movable with the second slide which is arranged to engage the second shoe and swing it into an operative position in supporting engagement with the work piece at a point below the work axis and adjacent to the line of contact between the grinding wheel and work support, means including a nut and screw to adjust the position of the cam relative to the second slide, a lost motion connection between said slides, a compression spring interposed between said slides, and means including a fluid pressure piston and cylinder which are operatively connected to move said slide which through the first slide moves the horizontal shoe into operative supporting engagement with the work after which the spring is compressed as continued movement of the second slide moves the cam to swing the second shoe into an operative position.

7. In a steady rest for a grinding machine having a base and a longitudinally movable table thereon, a bridge type steady rest frame which straddles said table, means adjustably to secure the ends of said frame to the base on opposite sides of the table, a slide movable transversely on said frame, a horizontally movable work steadying shoe on said slide, a manually operable nut and screw to adjust said shoe relative to said slide, a second work steadying shoe pivotally supported on said slide, and a slidably mounted cam on said frame to actuate the pivotally mounted shoe.

8. In a steady rest for a grinding machine having a base and a longitudinally movable table thereon, a bridge type steady rest frame which straddles said table, means adjustably to secure the ends of said frame to the base on opposite sides of the table, a slide movable transversely on said frame, a horizontally movable work steadying shoe on said slide, a manually operable nut and screw to adjust said shoe relative to said slide, a second work steadying shoe pivotally supported on said slide, a slidably mounted cam on said frame to actuate the pivotally mounted shoe, and means operatively connected to move said slide to position the horizontal shoe and thereafter to move said cam to shift said pivotally mounted shoe to an operative position.

9. In a steady rest for a grinding machine having a base and a longitudinally movable table thereon, a bridge type steady rest frame which straddles said table, means to adjustably secure the ends of said frame to the base on opposite sides of the table, a slide movable transversely on said frame, a horizontally movable work steadying shoe on said slide, a manually operable nut and screw to adjust said shoe relative to said slide, a second work steadying shoe pivotally supported on said slide, a slidably mounted cam on said frame to actuate the pivotally mounted shoe, and means including a piston and cylinder which are operatively connected to move said slide to position the horizontal shoe and thereafter to move said cam to shift said pivotally mounted shoe to an operative position.

ELPHEGE D. LA FLEUR.