April 15, 1947. H. A. SILVEN 2,419,170

GRINDING MACHINE-STEADY REST

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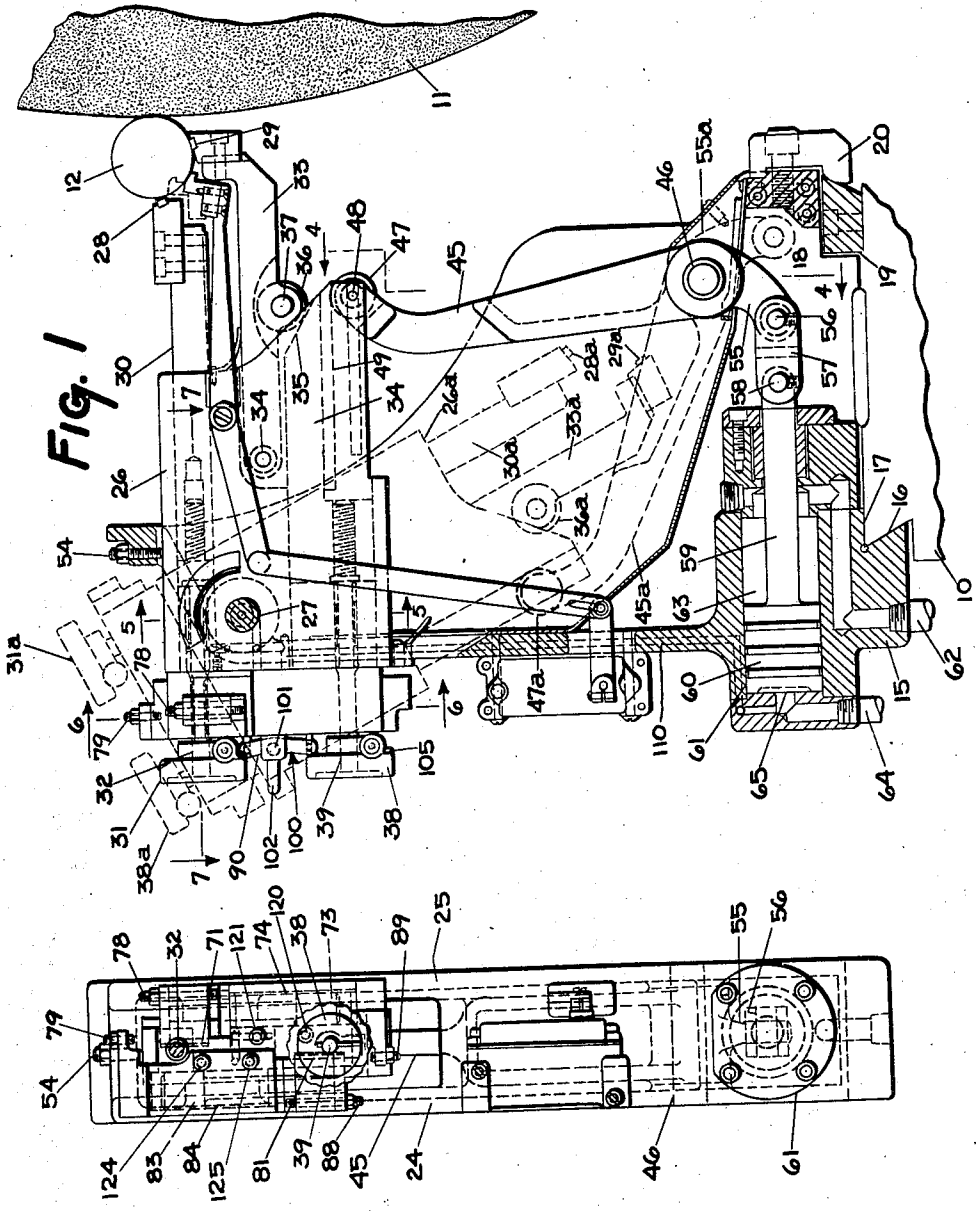


Fig. 1

Fig. 2

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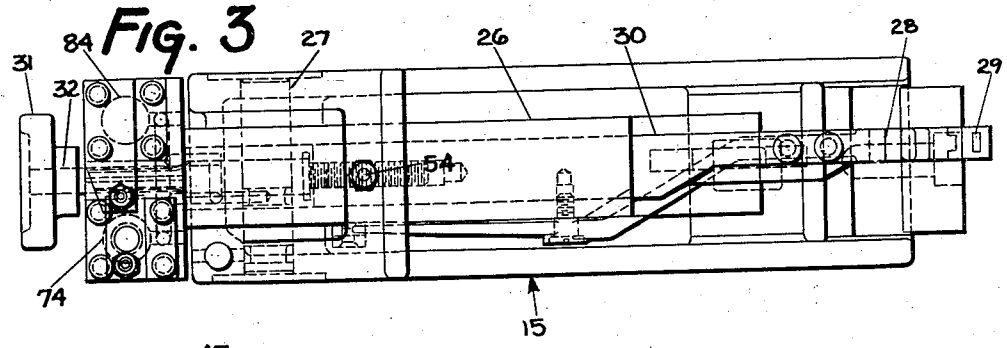
By Harold W. Eaton Attorney

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GRINDING MACHINE-STEADY REST

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FIG. 3



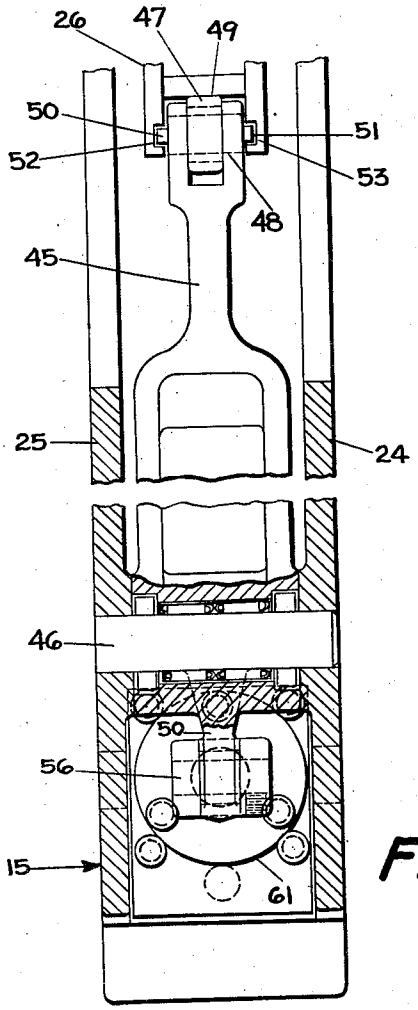
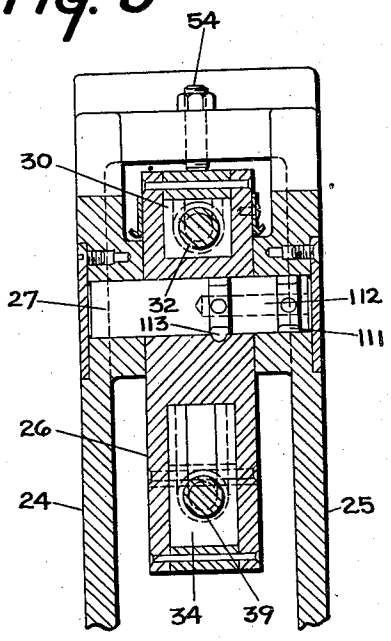


FIG. 4

FIG. 5



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FIG. 6

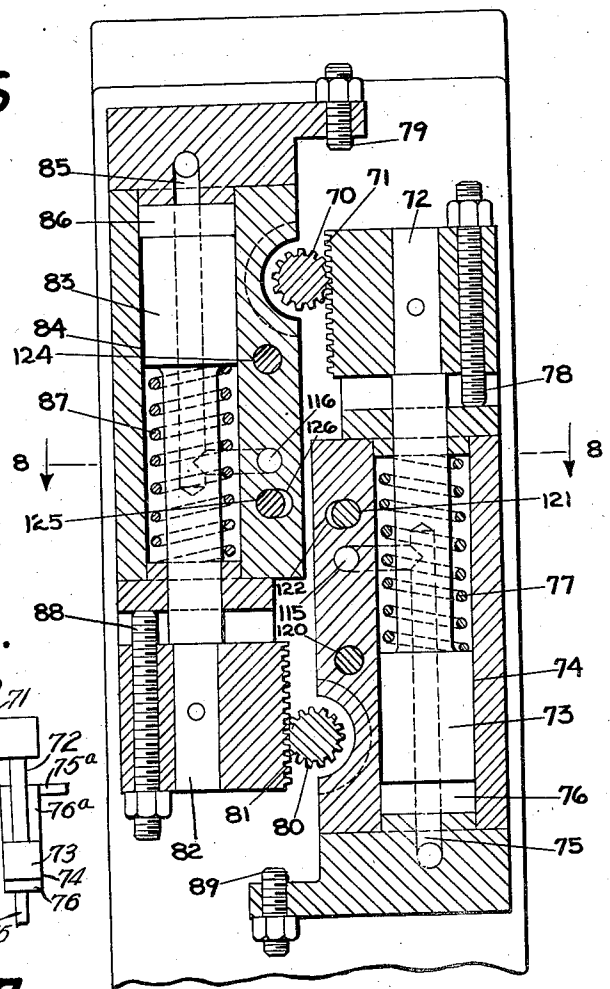


FIG. 12.

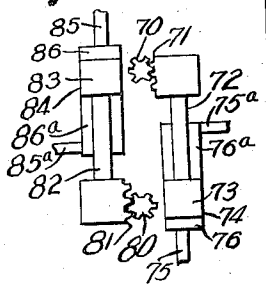
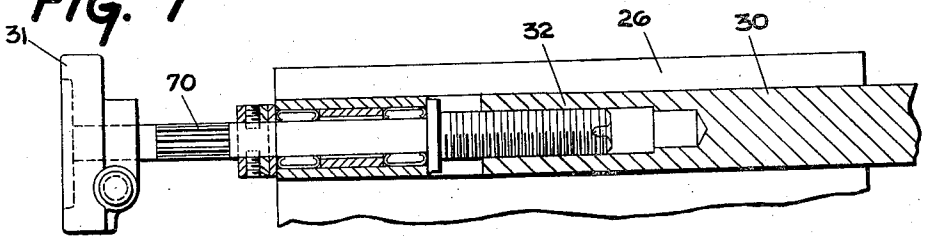


FIG. 7



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FIG. 8

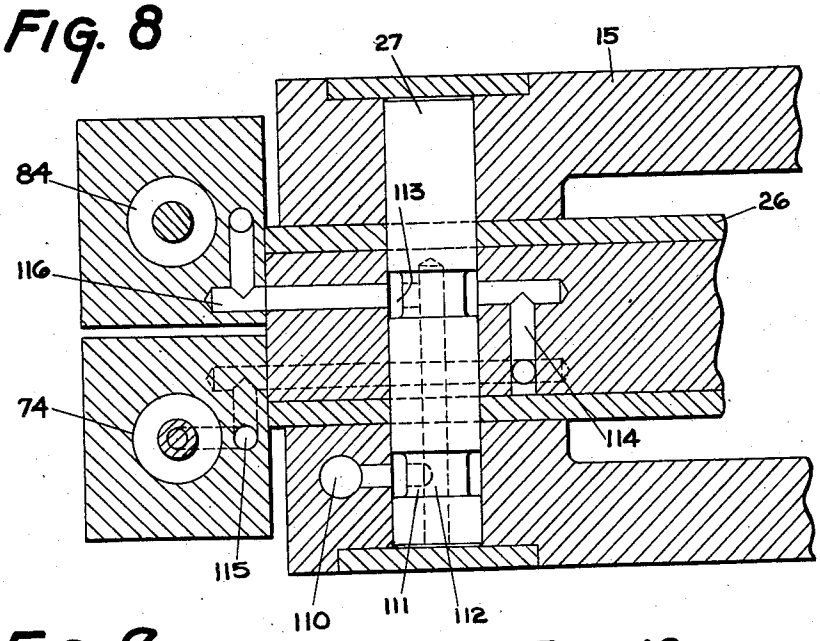


FIG. 9

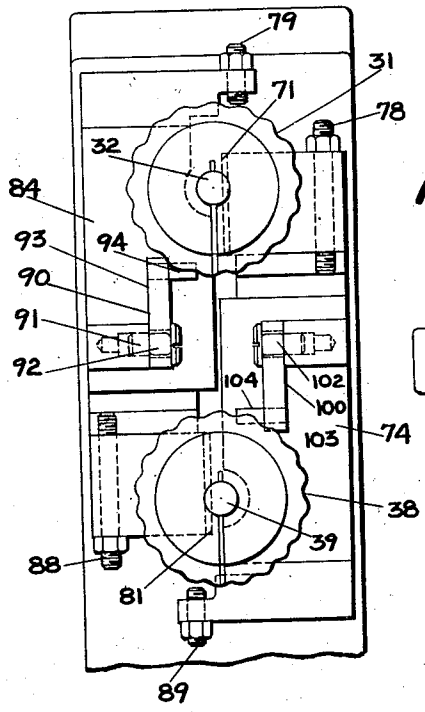


FIG. 11

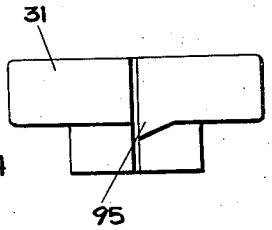
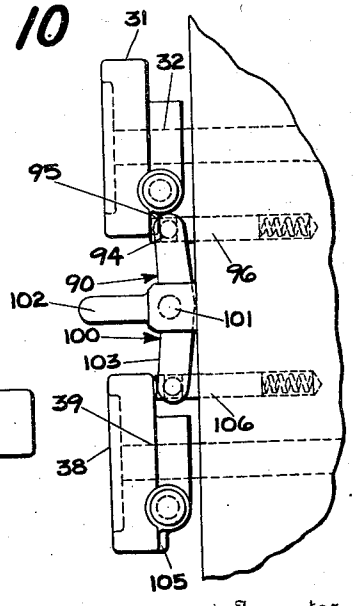


FIG. 10



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2,419,170

UNITED STATES PATENT OFFICE

2,419,170

GRINDING MACHINE STEADY REST

Herbert A. Silven, Worcester, Mass., assignor to Norton Company, Worcester, Mass., a corporation of Massachusetts

Application March 17, 1945, Serial No. 583,187

13 Claims. (Cl. 51—238)

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The invention relates to grinding machines, and more particularly to a steadyrest for supporting and steadying a work piece during a grinding operation.

One object of the invention is to provide a simple and thoroughly practical steadyrest for a cylindrical grinding machine. Another object of the invention is to provide a steadyrest which may be rapidly and readily moved to and from an operative position.

Another object of the invention is to provide a two-bearing shoe type steadyrest which is pivotally mounted and arranged so that it may be swung to and from an operating position to facilitate a longitudinal indexing movement of the work table or steadyrest relative to a crankshaft or the like. Another object of the invention is to provide a steadyrest in which the bearing shoes are pivotally mounted so that they may be swung to and from an operative position by means of a fluid pressure actuating mechanism so that the shoes may be removed to a point remote from the work piece to facilitate indexing of the work piece relative thereto.

Another object of the invention is to provide a steadyrest in which the steadyrest shoes are automatically advanced and maintained in operative engagement with the work during grinding. Another object of the invention is to provide automatic means to retract the steadyrest shoes after a grinding operation has been completed.

Another object of the invention is to provide a spring-actuated means for automatically advancing a steadyrest shoe and maintaining it in operative engagement with the work during grinding. Another object of the invention is to provide a hydraulically operated mechanism automatically to return the steadyrest shoes to their initial position after a grinding oteration has been completed.

Another object of the invention is to provide a steadyrest of the two-bearing shoe type in which a pair of independent nut and screw mechanisms are provided for adjusting the shoes to maintain them in the desired steadying engagement with the work during a grinding operation. Another object of the invention is to provide a steadyrest with a nut and screw adjusting mechanism for the steadyrest shoes which is spring actuated automatically to advance the shoes to maintain them in operative engagement with the work piece as it is being ground.

Another object of the invention is to provide a spring actuated mechanism for maintaining the work steadying shoes in operative contact with

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the work piece as it is ground away, combined with a hydraulically operated mechanism for returning the shoes to their initial position after a grinding operation has been completed. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, 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 drawings in which is shown one of various possible embodiments of the mechanical features of this invention,

Fig. 1 is a side elevation of the improved steadyrest;

Fig. 2 is a front elevation of the steadyrest shown in Fig. 1;

Fig. 3 is a plan view, on an enlarged scale, of the improved steadyrest;

Fig. 4 is a fragmentary vertical sectional view, on an enlarged scale, taken approximately on the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary vertical sectional view, on an enlarged scale, taken approximately on the line 5—5 of Fig. 1;

Fig. 6 is a vertical sectional view, on an enlarged scale, taken approximately on the line 6—6 of Fig. 1, showing the spring and fluid pressure mechanism for actuating the steadyrest shoes;

Fig. 7 is a fragmentary horizontal sectional view, on an enlarged scale, taken approximately on the line 7—7 of Fig. 1, showing the adjusting mechanism for the horizontal work steadying shoe;

Fig. 8 is a fragmentary cross-sectional view, taken approximately on the line 8—8 of Fig. 6;

Fig. 9 is a fragmentary front elevation, on an enlarged scale, of the steadyrest;

Fig. 10 is a fragmentary side elevation of the mechanism shown in Fig. 9;

Fig. 11 is a detail view of the shoe actuating knobs; and

Fig. 12 is a diagrammatic illustration of a modified construction in which fluid under pressure serves to advance the steadyrest shoes.

A steadyrest has been illustrated in the drawings mounted upon a grinding machine table 10 which is arranged for a longitudinally reciprocatory movement relative to the base of the machine, as is old and well known in the prior art. The improved steadyrest is particularly adapted for use on a crankshaft grinding machine such as, for example, that shown in the

prior U. S. patent to Herbert A. Silven, No. 2,151,666, dated March 21, 1939. In a machine of this type the steadyrest is automatically located on the machine table and is arranged so that it may be positioned opposite the operative face of a rotatable transversely movable grinding wheel 11 so that the steadyrest shoes will support and steady a work piece, such as a pin 12 of a crankshaft to be ground. The steadyrest frame together with the steadyrest shoes are arranged so that they may be readily moved to and from an operative position so that after one pin on the crankshaft has been ground, the steadyrest may be readily moved longitudinally relative to the table to position it in supporting engagement with another crankpin after the crankpin has been positioned in operative relation with the grinding wheel 11.

A steadyrest base 15 is provided which may be readily clamped in position on the work supporting table 10. The under surface of the steadyrest is provided with supporting bearing surfaces 16, 17, 18 and 19 which mate with correspondingly shaped surfaces on the work supporting table 10. A clamping block 20 is supported on the steadyrest frame 15 and serves to clamp the steadyrest base securely in an operative position on the table 10.

The steadyrest base 15 is preferably formed as a hollow casing having a pair of upwardly extending side plates 24 and 25 which serve as a support and guide for a pivotally mounted steadyrest frame 26. The steadyrest frame 26 is pivotally supported on a stud 27 which is fixedly mounted on the side plates 24 and 25 of the steadyrest base 15.

The steadyrest frame 26 serves as a support for a pair of work steadying shoes 28 and 29. The steadyrest shoe 28 is preferably positioned and arranged to engage the work piece at a point substantially diametrically opposite the point of contact between the grinding wheel 11 and the work piece 12. The shoe 28 is mounted on the forward end of a horizontally adjustable slide 30 which slides within an aperture formed within the steadyrest frame 26. A nut and screw adjusting mechanism is provided for adjusting the position of the slide 30 comprising a manually operable knob 31 which is mounted on the outer end of an adjusting screw 32. The screw 32 is screw threaded into a threaded aperture formed in the slide 30 (Figs. 1 and 7). The adjusting screw 32 is rotatably supported in the steadyrest frame 26 and is held against axial movement relative thereto so that a rotary adjustment of the screw 32 is transmitted to cause a transverse adjustment of the slide 30 and the shoe 28.

The steadyrest shoe 29 is preferably arranged to engage the under side of the work piece 12 at a point adjacent to the line of contact between the grinding wheel 11 and the work piece 12. The shoe 29 is mounted on a supporting arm 33 which is in turn pivotally supported on a stud 34 carried by the steadyrest frame 26.

To facilitate adjustment of the arm 33, a transversely adjustable slide member 34 is slidably mounted within the frame 26. The forward or right-hand end of the slide 34 (Fig. 1) is provided with a cam face 35 engaging a roller 36 which is supported by a stud 37 on the arm 33. A nut and screw adjusting mechanism is provided for the slide 34 comprising a manually adjustable knob 38 which is mounted on the outer end of an adjusting screw 39. The adjusting screw 39 is screw threaded into a threaded aperture in the slide 34. The adjusting screw 39 is rotatably supported by the steadyrest frame 26 and is held against axial movement relative thereto so that a rotary adjustment of the screw 39 is transmitted to cause a transverse adjustment of the slide 34. It will be readily apparent from the foregoing disclosure that adjustment of the slide 34 either toward or from the wheel 11 will transmit a swinging motion to the arm 33 through the roller 36 so as to move the work steadying shoe 29 either toward or from the surface of the work piece 12.

In order to attain one object of this invention, it is desirable to provide a suitable controlling mechanism for swinging the steadyrest frame 26 to and from an operative position so that when in an operative position, the shoes 28 and 29 are in a position remote from the work piece 12. This mechanism may comprise a pivotally mounted arm 45 which is pivotally supported on a stud 46 carried by the steadyrest base 15. The upper end of the arm 45 is provided with a roller 47 which is supported on a stud 48 carried by the arm 45. The roller 47 is arranged to engage a plane surface 39 formed on the steadyrest frame 26. In order to maintain the frame 26 in a predetermined relationship with the arm 45 during movement to and from an operative position, the stud 48 which supports the roller 47 is provided with two outwardly extending pins or studs 50 and 51 (Fig. 4) which slide within slots 52 and 53, respectively, formed in opposite side plates of the frame 26. An adjustable stop screw 54 is provided on the steadyrest base member precisely to locate the steadyrest frame 26 when in an operative position.

It will be readily apparent from the foregoing disclosure that if the arm 45 is swung in a counterclockwise direction, the roller 47 will roll along the surface 49 and the pins 50 and 51 riding within the grooves 52 and 53, respectively, will cause the frame 26 to swing downwardly in a clockwise direction (Fig. 1) to an inoperative position 26*a*, as shown in dotted lines in Fig. 1, with the work steadying shoes 28 and 29 assuming dotted line positions 28*a* and 29*a*.

To facilitate movement of the steadyrest frame 26 to and from an operative position, a fluid pressure actuating mechanism is provided. The arm 45 is provided with an integral downwardly extending arm 55 which projects below the stud 46. The arm 55 is connected by a stud 56 with a link 57. The other end of the link 57 is connected by a stud 58 with the right-hand end of the piston rod 59 (Fig. 1). A piston 60 is formed either integral with or fixedly mounted on the left-hand end of the piston rod 59. The piston 60 is slidably mounted within a cylinder 61 which is formed integral with or fixedly mounted on the steadyrest base 15.

When fluid under pressure from a source of supply is admitted through a pipe 62 into a cylinder chamber 63, the piston 60 is moved toward the left into the position illustrated in Fig. 1 with the frame 26 and the work steadying shoes 28 and 29 in operative engagement with the work piece 12. When it is desired to move the steadyrest frame 26 together with the work steadying shoes 28 and 29 to an inoperative position, fluid under pressure is admitted through a pipe 64 into a cylinder chamber 65 to cause the piston 60 to move toward the right (Fig. 1), which movement rocks the arm 45 in a counterclockwise direction into dotted line position 45*a* (Fig. 1) and swings the steadyrest frame 26 together with the work steadying shoes 28 and 29 into the

dotted line positions 26*a*, 28*a* and 29*a* shown in Fig. 1.

In order to attain one object of the invention, it is desirable to provide automatically operated means for actuating the adjusting screws 32 and 39 so that the work steadying shoes 28 and 29 may be maintained in operative engagement with the work piece 12 at the desired pressure as the work is ground away during a grinding operation. In the preferred form of this invention, a combined compression spring and hydraulic mechanism is provided for turning the adjusting screws 32 and 39 to advance the work shoes during a grinding operation and thereafter to return the work shoes 28 and 29 to their initial position.

The adjusting screw 32 is provided with a gear or pinion 70 which is formed thereon between the knob 31 and the screw threaded portion 32. The pinion 70 meshes with a rack bar 71 which is fixedly mounted on the upper end of a piston rod 72. A piston 73 is either formed integral with the piston rod 72 or is fixedly mounted thereon. The piston 73 is slidably supported within a cylinder 74. When fluid under pressure is admitted through a passage 75 into a cylinder chamber 76, it will cause an upward movement of the piston 73 (Fig. 6) to move the rack 71 upwardly and thereby cause a counterclockwise rotation of the pinion 70 and the adjusting screw 32. A compression spring 77 is provided within the cylinder 74 which surrounds the piston rod 72 and is interposed between the piston 73 and the upper head of the cylinder 74. The compression of the spring 77 serves normally to exert a downward pressure tending to cause a downward movement of the piston 73, which movement serves to cause a downward movement of the rack 71 and thereby to transmit a clockwise rotation to the pinion 70 and the screw 32. An adjustable stop screw 78 is provided to limit the downward movement of the rack bar 71 and the piston 73. A stop screw 79 is provided to limit the upward hydraulic movement of the piston 73 and the rack bar 70 so as to limit the counterclockwise rotation of the pinion 70 and the screw 32.

A similar mechanism is provided for actuating the steadyrest shoe adjusting screw 39. The screw 39 is provided with a pinion 80 which meshes with a rack bar 81. The rack bar 81 is fixedly mounted on the lower end of a piston rod 82. A piston 83 is either fixedly mounted on or formed integral with the piston rod 82 and is slidably supported within a cylinder 84. When fluid under pressure is admitted through a passage 85 into a cylinder chamber 86, it will cause a downward movement of the piston 83 which serves to rotate the pinion 80 and screw 39 in a counterclockwise direction. A compression spring 87 is provided within the cylinder 84 surrounding the piston rod 82 and is interposed between the piston 84 and the lower head of the cylinder 84. A stop screw 88 serves to limit the upward movement of the piston 83 under the influence of the compression spring 87. An adjustable stop screw 89 serves to limit the downward movement of the rack bar 81 and the piston 83 so as to limit the hydraulic counterclockwise rotation of the pinion 80.

The springs 77 and 87 are utilized to transmit a rotary motion to the adjusting screws 32 and 39 to advance the work steadying shoes 28 and 29 as the work is reduced in size during grinding and serve to maintain a desired operating pressure between the shoes 28 and 29 and the work piece 12. The hydraulically operated pistons 73 and 83 are utilized to rotate the adjusting screws 32 and 39, respectively, in opposite directions to retract the work shoes 28 and 29 to their initial position after a grinding operation has been completed. While a compression spring has been illustrated for rotating the adjusting screws 32 and 39 during a grinding operation, it should be understood that these springs may be eliminated and fluid under pressure admitted through a pipe 75*a* into the upper chamber 76*a* of the cylinder 74 and through a pipe 85*a* into the lower chamber 86*a* of the cylinder 84 to provide an advancing movement of the work steadying shoes 28 and 29 under the influence of fluid under pressure, if desired.

At the start of a grinding operation, it is desirable for the grinding wheel 11 to engage the periphery of the work piece 12 and grind off any irregularities and round up the work piece before the steadyrest shoes are moved into operative engagement therewith. It is desirable, therefore, to provide a suitable latch mechanism whereby the springs 77 and 87 may be held under compression during the initial stages of the grinding operation, after which the compression of the springs may be released automatically to move the shoes 28 and 29 into operative engagement with the work piece 12. A manually operable bell crank lever 90 is pivotally supported on a stud 91. The bell crank lever 90 is provided with a forwardly extending actuating arm 92. The bell crank lever 90 is also provided with an upwardly extending arm 93 which carries a stud 94. The stud 94 is arranged in the path of a lug 95 projecting from and formed integral with the knob 31. It will be readily apparent that the lug 95 engaging the stud 94 will hold the spring 77 under compression by preventing the knob 31 from rotating in a clockwise direction. A spring-pressed plunger 96 (Fig. 10) is provided normally to urge the bell crank lever 90 in a counterclockwise direction (Fig. 10) to maintain the stud 94 in the path of the lug 95.

When it is desired to release the compression of the spring 77 automatically to move the shoe 28 into operative engagement with the work piece 12, the arm 92 of the bell crank lever 90 may be moved upwardly (Fig. 9) to swing the bell crank lever 90 in a clockwise direction (Fig. 10) so as to throw the stud 94 out of the path of the lug 95 on the knob 31, thereby releasing the compression of the spring 77 which automatically rotates the screw 32 to advance the work shoe 28 into operative supporting and steadying engagement with the work piece 12.

A similar latch mechanism is provided for latching the spring 87 under compression. This mechanism comprises a bell crank lever 100 which is pivotally supported on a stud 101. The bell crank lever 100 is provided with a forwardly extending, manually operable arm 102. The bell crank lever 100 is also provided with a downwardly extending arm 103 which carries a stud 104. The stud 104 is arranged normally in the path of a stop lug 105 (Figs. 1 and 10) formed integral with the knob 38. The details of this stop lug 105 have not been illustrated since it is identical to the stop lug shown on the actuating knob 31 in Fig. 11. A spring-pressed plunger 106 normally serves to maintain the bell crank lever 100 in a position so that the stud 104 lies in the path of the stop lug (not shown) formed on the actuating knob 38. When it is desired to release the compression of the spring 87, the arm 102 is moved downwardly to rock the bell crank

lever 100 in a counterclockwise direction (Fig. 10) so as to move the stud 104 out of the path of the lug 105 formed on the knob 38 which releases the compression of the spring 87 and thereby causes an upward movement of the rack bar 81 to transmit a clockwise rotation to the pinion 80 so as to advance the slide 34 and thus move the work shoe 29 into operative supporting engagement with the work piece 12 and to maintain it in contact therewith at the desired pressure as the work piece is reduced in size during the grinding operation.

The cylinders 74 and 84 are adjustably mounted on the swinging frame 26. In order to supply fluid under pressure for actuating the pistons 73 and 83, fluid under pressure is preferably passed through the pipe 64 into a passage 110 formed in the steadyrest base 15 into a groove or chamber 111 formed in the periphery of the pivot stud 27 and into an axially extending bore 112 formed in the pivot stud 27. From the central bore 111 fluid under pressure passes radially into a groove 113 formed in the periphery of the stud 27. From the groove or chamber 113 surrounding the stud 27, fluid may pass through a passage 114 and a passage 115 which connects with the passage 75 to admit fluid under pressure to the cylinder chamber 26 at the lower end of the cylinder 84. Fluid under pressure entering the chamber 113 surrounding the stud 27 may also pass through a passage 116 which connects with the passage 85 to admit fluid under pressure to the cylinder chamber 86 so as to cause a downward movement of the piston 83. It will thus be readily apparent from the foregoing discdosure that fluid under pressure may be readily transmitted to the cylinders 74 and 84 in any position of the frame 26.

In order to facilitate a manual adjustment of the work steadying shoes 28 and 29 by means of actuating knobs 31 and 38, respectively, it is desirable to provide suitable means for disconnecting the rack bar 71 from the pinion 70 and the rack bar 81 from the pinion 80. When the rack bars 71 and 81 are disengaged from the pinions 70 and 80, respectively, the shoes 28 and 29 may be readily adjusted manually for the purpose of setting up the rest for a given work piece by actuation of the knobs 31 and 38, respectively. The cylinder 74 is preferably adjustably mounted on the steadyrest frame 26 by means of a pair of screws 120 and 121. The screw 120 serves as a pivot stud for the cylinder 74 and associated parts. The screw 121 passes through an elongated slot 122 formed in the cylinder block. It will be readily apparent from the foregoing disclosure that by loosening the screws 120 and 121, the cylinder block 74 may be readily swung in a clockwise direction so that the rack bar 71 is thrown out of engagement with the pinion 70, after which the steadyrest shoe 28 may be readily adjusted by manual rotation of the knob 31.

Similarly, the cylinder block 84 is adjustably mounted on the frame 26 by means of a pair of screws 124 and 125. The screw 124 serves as a pivot stud. The screw 125 passes through an elongated slot 126 in the cylinder block 84. It will be readily apparent from the foregoing disclosure that when it is desired to disconnect the rack bar 81, the screws 124 and 125 may be loosened, after which the cylinder block 84 may be swung in a clockwise direction to disengage the rack bar 81 from the pinion 80, thus allowing a manual adjustment of the steadyrest shoe 29 by rotation of the actuating knob 38.

The fluid pressure actuation of the screws 32 and 33 may be readily timed with the other operating mechanisms of the machine by connecting the passage 110 (Fig. 8) so that fluid will be admitted through the passage 110 in timed relation with the operation of the other mechanisms on the grinding machine.

The operation of this improved steadyrest will be readily apparent from the foregoing disclosure. Assuming adjustments have previously been made, a work piece 12 is placed in position on the machine and fluid under pressure is admitted through the pipe 62 into the cylinder chamber 63 to move the piston 60 toward the left (Fig. 1) so as to swing the arm 45 in a clockwise direction into the position illustrated in Fig. 1 so that the steadyrest frame 26 is swung upwardly to an operating position. The grinding wheel 11 may then be fed into grinding engagement with the work to rough grind or round up the surface of the work 12, after which the trip levers 92 and 102 may be actuated to release the compression of the springs 77 and 87, respectively, which serve in the manner above described automatically to rotate the screws 32 and 39 to move the shoes 28 and 29, respectively, into operative engagement with the surface of the work piece 12 and to maintain the shoes in operative contact therewith at a desired pressure as the work piece 12 is reduced in size due to grinding. If desired, the lower work steadying shoe 29 may be moved into engagement with the work piece 12 before the horizontal shoe 28 is moved into engagement therewith by tripping the latch so as to release the compression of the spring 87 before the compression of the spring 77 is released. Or, if desired, the horizontal shoe 28 similarly may be moved into engagement with the work piece 12 prior to the movement of the lower shoe 29 into engagement therewith.

After a grinding operation has been completed, fluid under pressure may be passed through the pipe 64 into the passage 110 in the steadyrest base 15 through the chamber 112 surrounding the stud 27, through the central bore 111, and into the passage 113 surrounding the stud 27, and then through either the passage 114 or 115 into the cylinder 74 and through the passage 116 to the cylinder 84 to actuate the pistons 73 and 83, respectively, to turn the pinions 70 and 80 in a counterclockwise direction so as to move the steadyrest shoes 28 and 29 out of operative engagement with the work piece 12 and to return them to their initial position ready for the next grinding operation.

When fluid under pressure is admitted through the pipe 64, due to the fact that less pressure is required to actuate the pistons 73 and 83, the steadyrest shoes 28 and 29 are first moved out of operative engagement with the work piece 12, after which fluid passing through the pipe 64 into the cylinder chamber 65 serves to swing the steadyrest frame to an inoperative position.

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 drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a grinding machine having a steadyrest

comprising a steadyrest base, a pivotally mounted steadyrest frame, a work steadying shoe adjustably mounted on said frame, means to adjust said shoe relative to said frame, means including a movable arm engagable with said frame, slidable connections between said arm and said frame, means to move said arm to move the frame and steadyrest shoe to and from an operative position, and means automatically to move said shoe, adjusting means automatically to feed and maintain said shoe in engagement with the work during a grinding operation.

2. In a grinding machine having a steadyrest comprising a steadyrest base, a pivotally mounted steadyrest frame on said base, a stud on said base which serves as a pivotal support for said frame, a work steadying shoe adjustably mounted on said frame, means to adjust said shoe relative to said frame, means including a pivotally mounted arm having a roller engageable with said frame, means to swing said arm to move the frame and steadyrest shoe to and from an operative position, and means automatically to actuate said shoe adjusting means automatically to maintain said shoe in engagement with the work during a grinding operation.

3. In a grinding machine having a steadyrest comprising a steadyrest base, a pivotally mounted steadyrest frame on said base, a stud supported on said base which serves as a pivotal support for said frame, a work steadying shoe adjustably mounted on said frame, means including a nut and screw mechanism to adjust said shoe relative to said frame, means including a pivotally mounted arm having a roller engageable with said frame, means to swing said arm to move the frame and steadyrest shoe to and from an operative position, and means automatically to actuate said nut and screw mechanism automatically to maintain said shoe in engagement with the work during a grinding operation.

4. In a grinding machine having a steadyrest comprising a steadyrest base, a pivotally mounted steadyrest frame on said base, a stud supported on said base which serves as a pivotal support for said frame, a work steadying shoe adjustably mounted on said frame, means including a nut and screw mechanism to adjust said shoe relative to said frame, means including a pivotally mounted arm having a roller engageable with said frame, means to swing said arm to move the frame and steadyrest shoe to and from an operative position, and means including a spring operatively connected to actuate said nut and screw mechanism automatically to maintain said shoe in engagement with the work during a grinding operation.

5. In a grinding machine having a steadyrest comprising a steadyrest base, a pivotally mounted steadyrest frame on said base, a stud supported by said base which serves as a pivotal support for said frame, a work steadying shoe adjustably supported on said frame, means including a nut and screw mechanism to adjust said shoe relative to said frame, means including a pivotally mounted arm having a roller engageable with said frame, means including a piston and cylinder operatively connected to swing said arm to move said frame and steadyrest shoe to and from an operative position, means automatically to actuate said nut and screw mechanism to move said shoe into operative engagement with the work and to maintain the shoe in operative engagement therewith during a grinding operation, and means automatically to rotate said shoe adjusting screw in the opposite direction to reposition the shoe after a grinding operation has been completed.

6. In a grinding machine having a steadyrest comprising a steadyrest base, a pivotally mounted steadyrest frame on said base, a stud supported by said base which serves as a pivotal support for said frame, a work steadying shoe adjustably supported on said frame, means including a nut and screw mechanism to adjust said shoe relative to said frame, means including a pivotally mounted arm having a roller engageable with said frame, means including a piston and cylinder operatively connected to swing said arm to move said frame and steadyrest shoe to and from an operative position, means including a spring automatically to actuate said nut and screw mechanism to move said shoe into operative engagement with the work and to maintain the shoe in operative engagement therewith during a grinding operation, and means including a piston and cylinder automatically to rotate said shoe adjusting screw in the opposite direction to re-position the shoe after a grinding operation has been completed.

7. In a grinding machine having a steadyrest, a steadyrest base, a pivotally mounted steadyrest frame on said base, a work steadying shoe adjustably supported on said frame, means including a manually operable mechanism to adjust said shoe relative to said frame, a pivotally mounted arm having a roller engageable with said frame, means to swing said arm to move said frame and steadyrest shoe to and from an operative position, normally latched means which is arranged to actuate said shoe adjusting mechanism in one direction to maintain the shoe in operative engagement with the work during a grinding operation, means including a piston and cylinder to adjust said shoe adjusting mechanism in the opposite direction to reposition the shoe after a grinding operation has been completed, and a manually operable latch on said steadyrest frame to release said normally latch means automatically to move the shoe into engagement with the work and to maintain it in engagement therewith during a grinding operation.

8. In a grinding machine having a steadyrest, a steadyrest base, a pivotally mounted steadyrest frame on said base, a work steadying shoe adjustably supported on said frame, means including a manually operable nut and screw mechanism to adjust said shoe relative to said frame, a pivotally mounted arm having a roller engageable with said frame, means including a piston and cylinder operatively connected to swing said arm to move said frame and steadyrest shoe to and from an operative position, a normally latched spring which is arranged to turn said shoe adjusting screw automatically in one direction to move the shoe into operative engagement with the work and to maintain the shoe in operative engagement therewith during a grinding operation, means including a piston and cylinder to rotate said shoe adjusting screw in the opposite direction to re-position the shoe after a grinding operation has been completed, and a manually operable latch on said steadyrest frame to release said spring automatically to allow the spring to move the shoe into operative engagement with the work.

9. In a grinding machine having a steadyrest, a steadyrest frame, a pair of work steadying shoes adjustably supported on said frame, an independent nut and screw mechanism independ-

ently to adjust each of said shoes relative to said frame, means including an independent normally latched spring independently to actuate each of said screws to move the shoes into operative engagement with the work and to maintain them in engagement therewith during a grinding operation, means including an independent piston and cylinder to rotate said shoe adjusting screws in the opposite direction independently to re-position said shoes after a grinding operation has been completed, and a pair of independently operated, manually operable latches on said steadyrest frame to release said springs automatically to allow said springs independently to move the shoes into engagement with the work and to maintain them in engagement therewith during a grinding operation.

10. In a grinding machine having a steadyrest comprising a steadyrest base, a pivotally mounted steadyrest frame on said base, a stud supported on said base which serves as a pivotal support for said frame, a pair of work steadying shoes adjustably mounted on said frame, means including an independent nut and screw mechanism to adjust each of said shoes relative to said frame, means including a pivotally mounted arm having a roller engageable with said frame, means to swing said arm to move the frame and steadyrest shoes to and from an operative position, means including a spring operatively connected to actuate said nut and screw mechanism automatically to move said shoes into engagement with said work and to maintain said shoes in operative engagement with the work during a grinding operation, and a manually operable adjusting knob on each of said shoe adjusting screws whereby the pressure of the shoes against the work may be manually increased or decreased as desired.

11. In a grinding machine having a steadyrest, a steadyrest frame, a pair of work steadying shoes adjustably supported on said frame, an independent nut and screw mechanism independently to adjust each of said screws relative to said frame, an independent rack and gear mechanism independently to rotate each of said screws, means including an independent normally latched spring independently to actuate each of said rack and pinions to move said shoes into operative engagement with the work and to maintain them in engagement therewith during a grinding operation, means including an independent piston and cylinder to rotate each of said shoe adjusting screws in the opposite direction independently to re-position said shoes after a grinding operation has been completed, a manually operable knob on each of said shoe adjusting screws, and means for disconnecting each of said rack and pinions so that the shoe adjusting screws may be manually adjusted to position both of the work shoes relative to said frame.

12. In a grinding machine having a steadyrest, a steadyrest base, a pivotally mounted steadyrest frame on said base, a pair of work steadying shoes adjustably supported on said frame, means including an independent manually operable nut and screw mechanism independently to adjust each of said shoes relative to said frame, a pivotally mounted arm having a roller engageable with said frame, means including a piston and cylinder operatively connected to swing said arm to move said frame and steadyrest shoes to and from an operative position, independent spring actuated means independently to turn said shoe adjusting screws automatically in one direction to move the shoes into operative engagement with the work and to maintain the shoes in operative engagement therewith during a grinding operation, means including an independent piston and cylinder to rotate each of said shoe adjusting screws in the opposite direction to re-position the shoes after a grinding operation has been completed, and fluid pressure interconnections between the frame actuating cylinder and the shoe re-positioning cylinders whereby the shoes are automatically withdrawn from engagement with the work before the steadyrest frame is swung to an inoperative position.

13. In a grinding machine having a steadyrest, a steadyrest base, a pivotally mounted steadyrest frame on said base, a pair of work steadying shoes adjustably supported on said frame, a pivotally mounted arm having a roller engageable with said frame, means including a piston and cylinder operatively connected to swing said arm to move said frame and steadyrest shoes to and from an operative position, an independent nut and screw mechanism independently to adjust each of said shoes relative to said frame, means including an independent normally latched spring independently to actuate each of said screws to move the shoes into operative engagement with the work and to maintain them in engagement therewith during a grinding operation, means including an independent piston and cylinder to rotate said shoe adjusting screws in the opposite direction independently to reposition said shoes after a grinding operation has been completed, and a pair of independently operated, manually operable latches on said steadyrest frame to release said springs automatically to allow said springs independently to move the shoes into engagement with the work and to maintain them in engagement therewith during a grinding operation.

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