May 12, 1936. J. SUNNEN 2,040,281

ENGINE CYLINDER GRINDING MACHINE

Filed Aug. 22, 1935

FIG. 1.

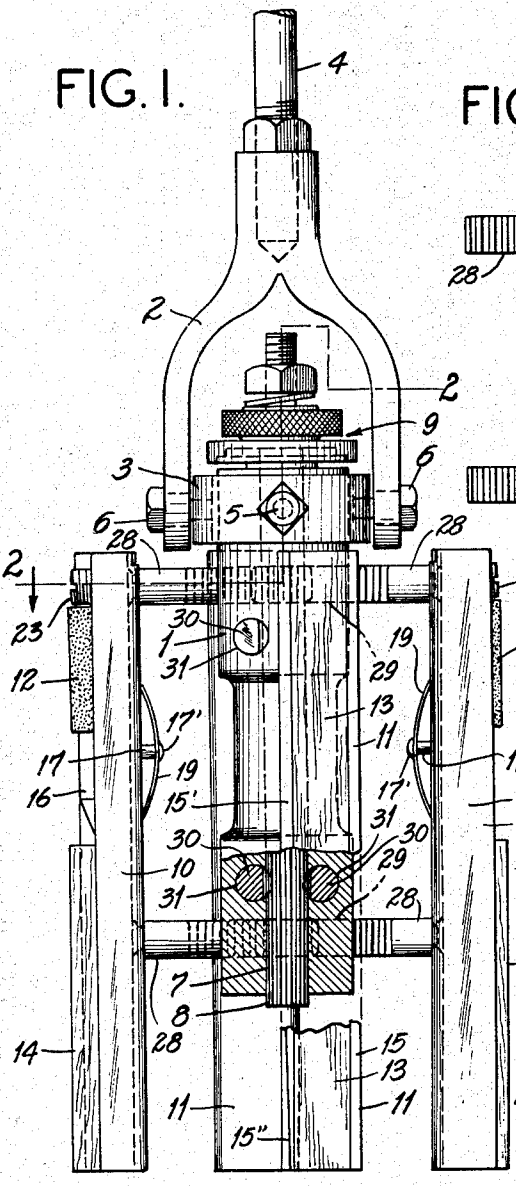


FIG. 5.

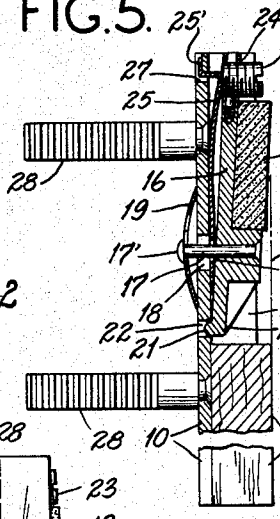


FIG. 4.

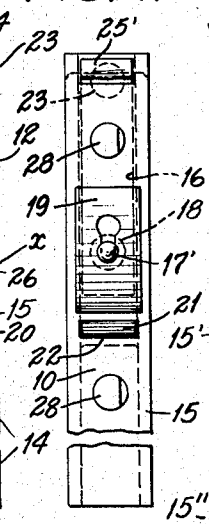


FIG. 3.

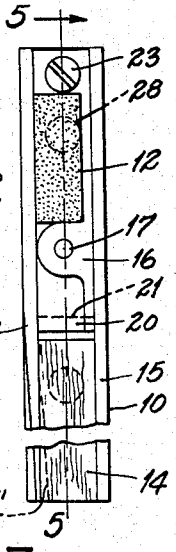


FIG. 6.

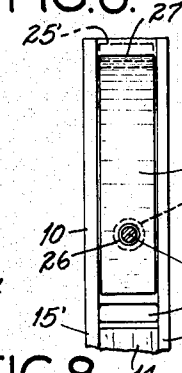


FIG. 7.

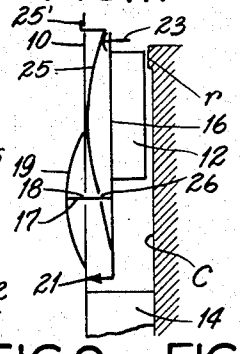


FIG. 2.

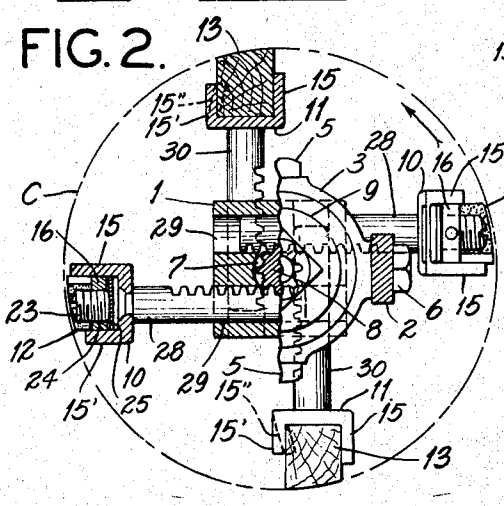


FIG. 8.

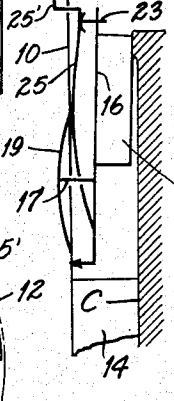


FIG. 9.

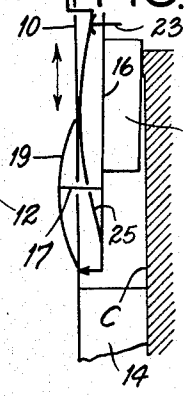
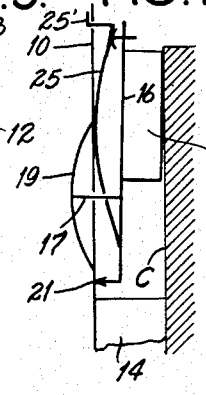


FIG. 10.



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ENGINE CYLINDER GRINDING MACHINE

Joseph Sunnen, Kirkwood, Mo.

Application August 22, 1935, Serial No. 37,305

10 Claims. (Cl. 51—184.1)

My invention has relation to improvements in engine cylinder grinding machines and consists in the novel features of construction more fully set forth in the specification and pointed out in the claims.

The present invention is a modification of that shown in my Patent No. 1,982,836, dated December 4, 1934. The grinding machine or honing device of said patent is constructed and arranged primarily for regrinding and refinishing cylinder bores in their entirety, while the principal object of the present invention is for regrinding and refinishing only the upper part of said bores. It is a matter of common knowledge among automobile mechanics and technicians that after an engine has been operated for a certain period of time the bores of the cylinders wear throughout that part of their length in which the piston rings travel so that ultimately a well defined ridge is formed at the top of each cylinder bore.

As stated above, it is the object of my present improved grinder to remove such ridges thus formed near the top of the cylinder without in any wise affecting the balance of the cylinder. In order to accomplish this object I have provided a modified form of abrasive stone and holder therefor especially adapted to be applied to remove said ridge, the other parts of the grinding machine being in all substantial respects the same as those of my Patent No. 1,982,836 aforesaid.

Thus, the present invention, while being directed to improvements in grinding machines, is more directly concerned with the abrasive stones of said grinding machines as will more fully appear hereinafter in connection with the detailed description of the invention in connection with the accompanying drawing, in which:

Figure 1 is a side elevation of a grinding machine provided with my improved abrasive stones and holders therefor, part of said machine being broken away; Fig. 2 is a horizontal cross-section taken through the machine on the line 2—2 of Fig. 1; Fig. 3 is a front elevation of my improved abrasive stone and holder therefor; Fig. 4 is a rear elevation thereof; Fig. 5 is a vertical longitudinal section taken through the stone holder on the line 5—5 of Fig. 3; Fig. 6 is an elevational detail looking into the upper part of the channel of the stone holder, with the stone removed; Fig. 7 is a diagrammatic view showing the application of the abrasive stone to the ridge in the cylinder wall before said stone has been adjusted to perform a grinding operation; Fig. 8 is a diagrammatic view showing the position of the abrasive stone relative to said ridge after being adjusted for the start of the grinding operation; Fig. 9 is a diagrammatic view showing a further adjustment of the abrasive stone after the grinding has proceeded a while but before the ridge is entirely removed; and Fig. 10 is a diagrammatic view showing the adjustment of the grinding stone when the ridge is completely removed.

Referring to the drawing, 1 represents the tool carrier of a Sunnen cylinder grinder of the type described in the above referred to patent, said carrier being suspended by a yoke 2 and a collar 3 from a drive shaft 4. The collar 3 is pivotally connected to the carrier 1 by means of studs 5, 5, and the yoke 2 is pivotally connected to the collar by means of studs 6, 6 so that a universal joint connection is formed between the shaft 4 and the carrier 1. The carrier 1 is provided with a longitudinally disposed axial bore 7 within which is housed a pinion shaft 8 rotatable by means of the adjusting head 9 for the purpose of extending and retracting abrasive element holders 10, 10 and guide element holders 11, 11 in which are fixed abrasive stones 12, 12 and guide blocks 13, 13 respectively. The construction and operation of the tool carrier, comprising the parts just described, is substantially the same as that of the carrier of my holding device described in detail in the aforesaid patent and will not be further described herein except insofar as necessary to explain the operation of the abrasive stones 12, 12.

Each of the abrasive stone holders 10 is channel-shaped and has a guide block 14 mounted in the lower part of the channel, said block being securely held in place by being wedged between the sides 15, 15' of the channel, the latter having that portion 15'' which contacts with the block crimped inwardly against the block 14. The extent of the crimping increases downwardly to the lower end of the block so that the crimped portion 15'' also forms a wedge whereby the block may be tightened by driving the same downwardly in the channel.

A mount 16 to which the abrasive stone 12 is securely fixed is disposed in the upper part of the channel of holder 10 and is held therein by a stem 17 which projects rearwardly through an opening 18 in the bottom of holder 10, the head 17' of the stem 17 engaging a flexed spring 19 which exerts pressure on the mount 16 to hold the same within the channel. In order that the mount may not move longitudinally its lower end 20 has a laterally extending bead 21 projecting into a slot 22 in the bottom of the holder 10. At the upper end of the mount 16 beyond

the abrasive stone 12 is a set screw 23 operating through a tapped opening 24, the inner end of which screw is adapted to bear against the upper end of a flexed spring 25 disposed between the mount 16 and the bottom of the channel of holder 10, said spring extending downwardly to near the lower end of the mount and having an opening 26 through which passes the stem 17. The upper extremity 25' of the spring 25 is offset from the main portion of the spring and projects through a transverse slot 27 in the bottom of the channel. The amount of the offset at the upper end of spring 25 is just sufficient for a slight inward movement of the mount 16 when pressure is applied against the outer face of the stone 12. Thus, the spring 25 cushions the shocks to which the stone 12 is subjected in its operation, as will be hereinafter more fully apparent.

It is apparent that by turning the set screw 23 it will be either withdrawn from the mount 16 or moved further through said mount, the result of which is to cause said mount to be closely nested within the channel of the holder 10 or tilted outwardly therefrom about the bead 21 as a fulcrum. The spring 19 tends to hold the mount 16 closely within the channel while the spring 26 acting against the screw 23 overcomes the force of the spring 19 and keeps the mount pressed outwardly a slight amount in the absence of outward pressure against the face of the stone 12.

The holders 10 are supported by rack bars 28, 28 slidably mounted in transverse bores 29, 29 in the carrier 1, and the holders 11, 11 are supported by rack bars 30, 30 slidably mounted in transverse bores 31, 31 in the carrier 1. Obviously, when the shaft pinion 8 is rotated the rack bars of both the holders 10 and 11 will be simultaneously moved either outwardly or inwardly to affect the required adjustment of the stones and guide blocks.

It will be observed that when the mount 16 is adjusted to its innermost position within the channel of the holder 10 the outer surface of the stone 12 lies inside the outer surface of the guide block 14, as indicated by the line x representing a continuation of the outer surface of block 14 (Fig. 5). The reason for this will be apparent in the diagrammatic view of Fig. 7. In Fig. 7 C represents the bore of the cylinder, at the top of which is a ridge r formed by the wear of the piston ring during the operation of the engine. In inserting the grinding machine within the cylinder C it is desirable that the stones 12 have a slight clearance opposite the ridge r after the holders 10, 10 and 11, 11 have been adjusted so that the blocks 13 and 14 are in operative relation to the cylinder wall. This adjustment is obtained by manipulation of the adjusting head 9. Fig. 7 shows the relative positions of the guide block 14, abrasive stone 12, the cylinder C and ridge r with the machine applied to the cylinder for the purpose of removing said ridge, but before the final adjustment of the stone 12 has been made to start the grinding operation. This last adjustment is obtained on the stone 12 by turning the screw 23 until the mount 16 tilts outwardly sufficient to allow the stone 12 to contact with the surface of the ridge r. In making this last adjustment the screw 23 is turned not only until the stones 12 are in contact with the ridge r that is to be removed, but also until the flexed spring 25 is flattened out against the bottom of the channel of holder 10. Fig. 8 diagrammatically represents such position of the stone 12. Power may now be applied to the machine to cause the carrier 1 to rotate so that the stones 12 will ride over the surface of the ridge r and perform an abrading action thereon.

During the rotation of the carrier 1 the operator moves the same up and down so that the wear may be distributed over the face of the stone 12. As the surface of the stone 12 wears by the abrading contact over the ridge r the pressure of the spring 25 keeps moving the stone outwardly to compensate for this wear, thus continually maintaining the stone in working contact with said ridge. When the ridge has been worn off to such an extent so that the grinding operation has ceased and the machine is merely rotating idly, the operator effects a further adjustment of the screw 23 to allow the mount 16 to be tilted outwardly a slightly further distance when the grinding action is resumed. Fig. 9 diagrammatically represents the position of the parts after this further adjustment of the stone 12. The grinding operation now continues, successive adjustments of the screw 23 being made as required until finally the ridge is completely removed when we have the stone in the position diagrammatically represented in Fig. 10. As the operator makes his adjustments by means of the screw 23 he is careful to observe that the extremity 25' of the spring 25 remains in contact with the outer surface of the bottom of holder 10 as this insures freedom of the spring 25 to move inwardly under the shocks and vibration during the operation of the machine so that the stones 12 will always be cushioned by the resilience of the springs behind them.

By virtue of the inclined position of the face of the stone 12 relative to the wall of the cylinder C, the lower edge of said stone is tilted away from said cylinder wall so as not to accidentally contact therewith and score the same. As the ridge r is gradually worn away and the upper part of the stone wears so that adjustments have to be made in order to tilt the stone outwardly to take up for this wear, the inclination of the stone 12 relative to the cylinder wall increases and the factor of safety against scoring of the cylinder wall by contact with the lower edge of the stone 12 also increases.

Having described my invention, I claim:

1. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, and supporting members for the holder.

2. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone tiltably mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, and supporting members for the holder.

3. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone yieldingly mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, and supporting members for the holder.

4. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone yieldingly held in the holder adjacent to one end thereof, the inner end of the stone being fulcrumed on the holder, a guide block fixed in said holder in longitudinal alinement

with the stone, and supporting members for the stone.

5. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone tiltably mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, means for tilting said stone to effect adjustment thereof, and supporting members for the holder.

6. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, the outer face of the guide extending beyond the outer face of the stone, and supporting members for the holder.

7. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone tiltably mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, a spring exerting its tension to hold the stone within the holder, a second spring exerting its tension near the free end of the stone to tilt the same outwardly from the holder, and supporting members for the holder.

8. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone tiltably mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, a spring exerting its tension to hold the stone within the holder, a second spring exerting its tension near the free end of the stone to tilt the same outwardly from the holder, means for varying the tension on said second spring, and supporting members for the holder.

9. In a cylinder grinding machine, an abrasive element comprising an elongated holder, an abrasive stone mounted in the holder adjacent to one end thereof, a guide block fixed in said holder, said holder having a wedge-shaped flange engaging the block along one side thereof, and supporting members for the holder.

10. An abrasive element for grinding machines comprising a channel-shaped holder having supporting members projecting from the back of said channel, a mount arranged within the holder near one end thereof, the inner end of the mount having pivotal connection with the bottom of the channel so the mount is free to tilt back and forth within the channel, a spring exerting its tension on the mount to hold the same within the channel, a second spring opposing the action of the first spring to cause the mount to tilt outwardly from the channel, adjusting means on the mount for varying the extent of the tilting action, an abrasive stone affixed to the mount and having its outer face projecting beyond the sides of the channel, and a guide block fixed in the channel and projecting beyond the outer face of the stone.

JOSEPH SUNNEN.