Oct. 30, 1934. M. C. HUTTO 1,978,428

GRINDER FOR CYLINDRICAL SURFACES

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Fig. 1.

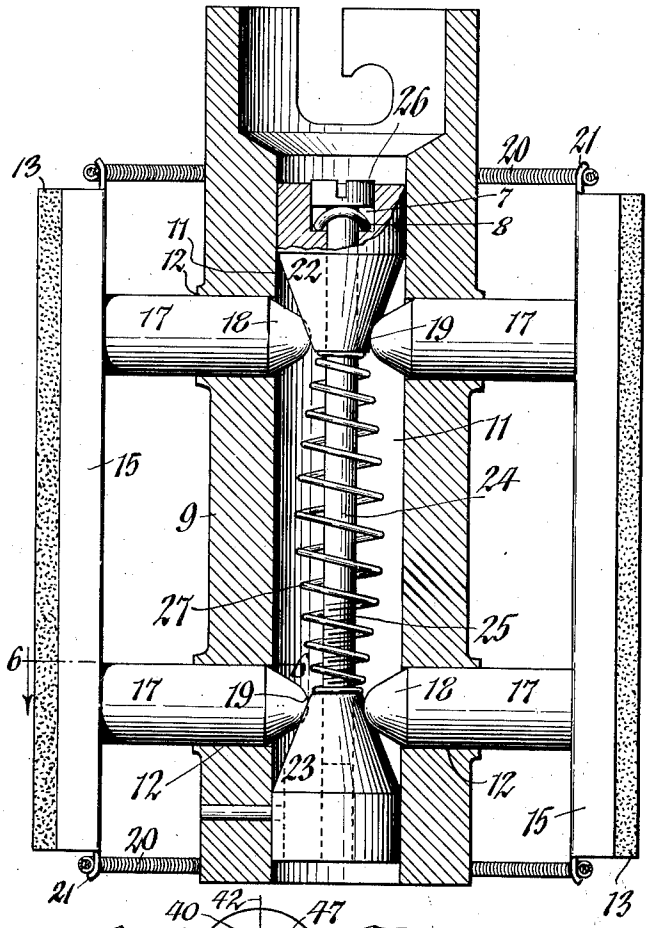
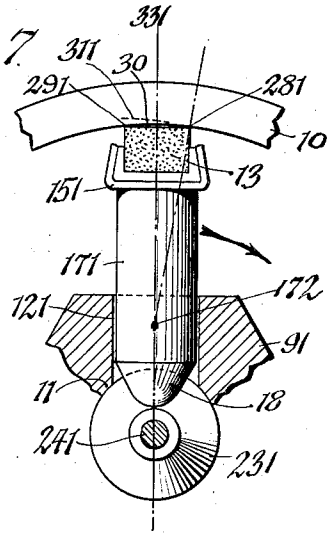


Fig. 7.



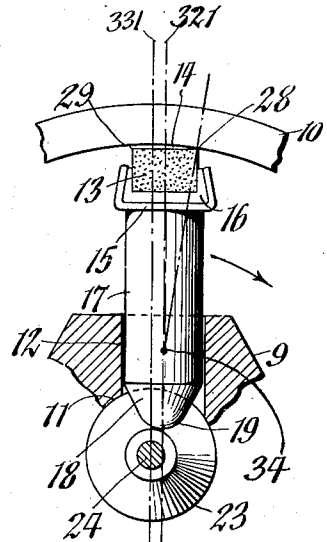


Fig. 6.

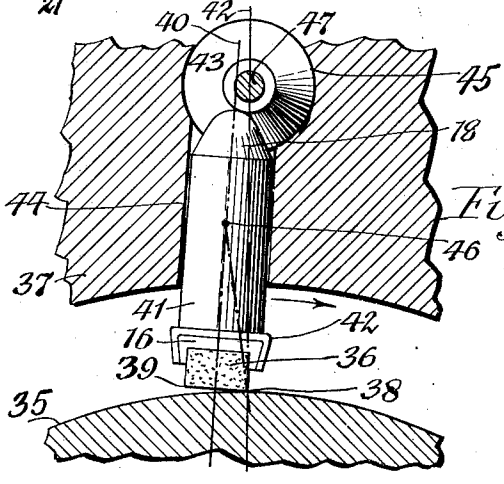


Fig. 8.

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Fig. 2.

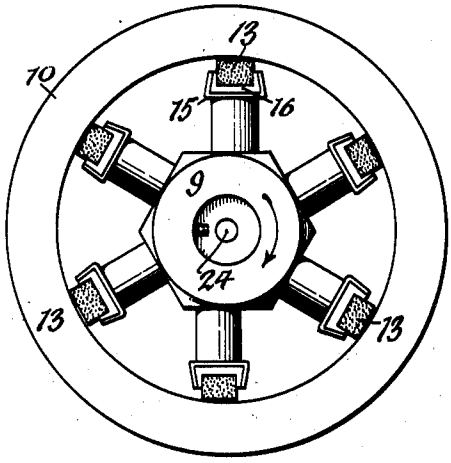


Fig. 3.

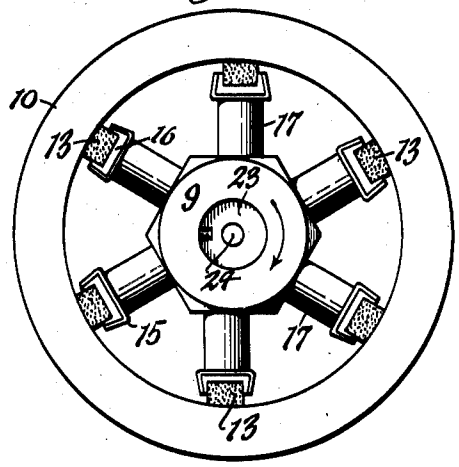


Fig. 4.

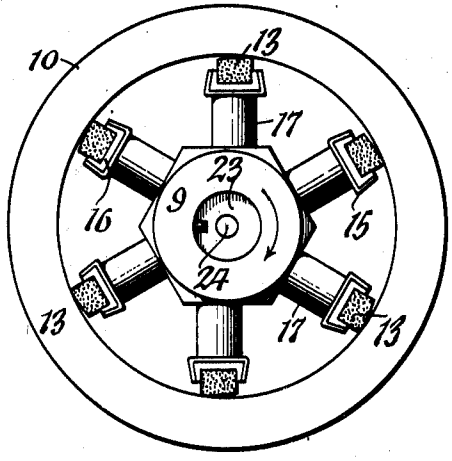


Fig. 5.

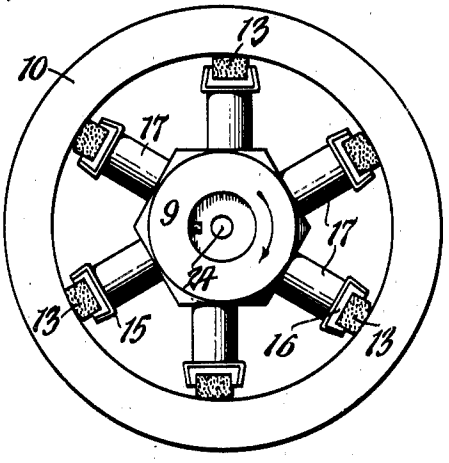


Fig. 9.



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GRINDER FOR CYLINDRICAL SURFACES

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Application December 28, 1929, Serial No. 417,160

16 Claims. (Cl. 51—184.3)

This invention relates to an apparatus for grinding cylindrical surfaces and more particularly the bores of cylinders used in gas engines, steam engines, pumps, and also all other cylindrical openings which require accuracy of workmanship in order to perform their functions most efficiently and economically. Heretofore it has been customary in grinders for this purpose to mount the abrasive elements on the rotatable and reciprocable body of the tool so that these elements could be adjusted on lines radiating from the axis of the tool, thereby causing the lead or advancing corner and the heel or trailing corner at the front and rear edges of the face of each abrasive member to bear against the bore of the cylinder on opposite sides of a radial line of the tool. In order to obtain freedom in the radially sliding movement of the abrasive holder or carrier on the body some clearance is usually provided between the holder or carrier guiding means and the body, which clearance permits a slight rearward tilt of the holder or carrier and its abrasive member relative to the cylindrical surface of the body being ground during operation of the tool. Such rearward tilt of the abrasive member is liable to cause a part of the outer face of the abrasive member to be broken away, particularly when the abrasive member is adjusted comparatively tight or close to the surface to be ground, inasmuch as under these conditions the tilting of the abrasive member will move the front or advancing corner outwardly toward the cylindrical surface and dig into the same with a gripping or clutch like effect to such extent that the above mentioned breaking away of a part of the abrasive face will result, particularly at the front corner thereof, and thus not only waste the abrasive material unnecessarily but also reducing the grinding capacity which an abrasive member should yield.

It is the object of this invention to so mount the abrasive members on the supporting body of the tool that not only will the above mentioned undesirable action be avoided, but an added advantage will be obtained consisting in permitting the heels of the abrasive members to automatically swing away and clear themselves from the cylindrical surface which is being ground and only present its front cutting edge to such surface during the grinding operation, and also enabling the abrasive members to be reversed end for end and exchanging the position of their front and rear corners so that when the advancing corners or leads have been worn down to a comparatively dull condition the same may be replaced by the rear or trailing corners or heels which are still comparatively sharp, thereby utilizing the abrasive members to a greater extent and maintaining the same in a higher state of efficiency so that grinding work of this character can be accomplished more expeditiously, conveniently and economically.

In the accompanying drawings:

Figure 1 is a longitudinal section of a cylinder grinder embodying a satisfactory form of my invention for grinding the bore or interior of cylindrical bodies.

Figure 2 is an end elevation of the same showing the form of the abrasive members or grinding stones as they appear when first adjusted to the surface of the cylinder which is to be ground.

Figure 3 is a similar view showing the form of the abrasive members or stones after the initial wear on the advancing or front outer corners of the same has occurred.

Figure 4 is a similar view showing the abrasive members or stones reversed fore and aft from the position shown in Fig. 3.

Figure 5 is a similar view showing the form of the stones or abrasive members after the same have become worn through use in the fore and aft reversed position.

Figure 6 is a diagrammatic sectional view taken on line 6—6 Fig. 1, but on an enlarged scale compared with Figs. 2–5, and showing an abrasive member mounted with its center in advance of a radial line from the axis of the body of the tool and also showing the manner in which a rearward tilt of the abrasive member or stone relative to the body, due to a loose fit of the radial guiding means for the abrasive member on the body, tends to free the heel of the stones or abrasive members from the internal cylindrical surface to be ground.

Figure 7 is a similar diagammatic view showing a holder or carrier for an abrasive member or stone mounted to slide on a true radial line of the axis of the tool body, as has been the practice heretofore, and the manner in which the abrasive member or stone will swing outwardly and dig, clutch or grip the internal cylindrical surface to be ground upon starting the grinding operation due to the fit of the means for guiding the abrasive carrier on the body being sufficiently free to permit a slight rearward tilt of the abrasive carrier relative to the body.

Figure 8 is a fragmentary view similar to Fig. 6 showing this invention embodied in an appa-

ratus for grinding the external cylindrical surfaces of articles.

Figure 9 is a perspective view of one form of spring means for yieldingly connecting the cones of the cam means forming part of the mechanism for adjusting the diameter of the abrasive members.

In the following description similar characters of references indicate like parts in the several figures of the drawings.

Referring to the internal cylindrical grinder shown in Figs. 1–5, the numeral 9 represents the body of the tool which may be rotated and also reciprocated by any suitable means while the tool is in use for grinding the cylindrical bore of a cylinder 10 or similar opening in other objects. This body is provided in the present example with a longitudinal bore 11 and a plurality of pairs of guideways or openings 12, 12 extending transversely from the bore 11 of the body to the periphery thereof.

Arranged in an annular row around the exterior of the body are a plurality of abrasive members or grinding stones 13 of any suitable or approved composition or material, each stone having preferably the form of a bar or stick which is rectangular in cross section and arranged lengthwise of the tool body.

Each of these abrasive members, stones or sticks is mounted on the body of the tool so as to be adjustable toward and from the longitudinal axis thereof and permit of engaging the outer surfaces or faces 14 of the stones with cylindrical bores of different diameters, and also permit the stones to rock or tilt lengthwise so that the same can adapt themselves to cylinders having bores which are more or less of tapering form, said stones being also held substantially rigid against contraction or movement away from the surface which is being ground. Although various means may be employed for thus supporting, guiding and adjusting the stones, those shown in the drawings have been found satisfactory and comprise a plurality of longitudinal stone holders 15 arranged in an annular row around the body of the tool and each preferably constructed of metal which is of channel form in cross section and has an abrasive stone secured therein by an adhesive 16.

In the guide openings 12 of each pair which are in line lengthwise of the body are arranged transversely movable two guide pins, rods or members 17, which engage with and are preferably, though not necessarily connected at their outer ends with the inner side of one of the stone holders adjacent to opposite ends thereof while the inner ends of these guide pins project into the bore of the body. Each of the guide pins has its inner part 18 tapered and its inner end rounded, as shown at 19.

The several stone holders and the parts associated therewith are yieldingly held against expansion by any suitable means, such for example as the annular springs 20 engaging with hooks 21 at opposite ends of the stone holders.

Within the longitudinal bore of the body is arranged the diameter adjusting means for the abrasive members or stones, which means in the particular embodiment shown in the drawings comprises two opposed cones, cams or wedges 22, 23 movable lengthwise in the bore of the body and engaging respectively with the guide pins at opposite ends of the stone holders, a longitudinal adjusting screw 24 passing through said cones and connecting the same by engaging the thread 25 at one end thereof with a threaded opening in one cone and engaging the head end 26 at its opposite end with the outer side of the other cone, and a spring 27 surrounding said screw and bearing at its opposite ends against the opposing ends of said cones.

In addition to the foregoing the stone adjusting mechanism includes, as an improvement on former constructions, resilient means as part of the cam device which permit of exerting a tension or follow-up action on the cones and yet hold the cones substantially rigid in position so that the same cannot be spread by inward pressure against the face of the stones. Although this resilient tension or take-up means may be variously organized the same preferably consists of a heavy ring shaped spring 8 which is stronger than the cone separating spring 27 and arranged around the screw 24 within a pocket 7 in the upper end of the cone 22 and bears with its opposite sides against the bottom of said pocket and the underside of the head 26 of the screw, as shown in Fig. 1. The taper of the cam or wedge surfaces of the cones 22, 23 is such that the same present an angle of repose to the inner ends of the stone guide pins 17 so that any inward pressure against the face of the stones will not be able to separate the cones and reduce the working diameter of the same, but any tension on the spring 8 will operate to move the cones lengthwise toward each other and automatically take up wear on the faces of the stones and hold them firmly in engagement with the bore of the cylinder so that the tool when temporarily detached from its driving mechanism for the purpose of adjusting the diameter of the same, will not drop out of the cylinder which is being ground.

The general operation in using this tool, so far as thus described, consists in first turning the screw 24 backwards to permit the cones 22 and 23 to separate and the stone holders to be drawn inwardly by the springs 20 to reduce the diameter of stones sufficiently to enable them to enter the cylinder to be ground. After the tool has been introduced into this cylinder the screw 24 is turned forward to draw the cones 22, 23 together and thereby expand or increase the diameter of the stones and engage the outer faces thereof tightly with the bore of the cylinder.

Upon adapting the tool to the cylindrical surface to be ground the screw 24 is not only turned forwardly sufficiently to engage the stones with the wall of the cylinder to be ground but this screw is turned forwardly an additional extent so as to compress or put the spring 8 under tension. The effect of this is that when the face of the stone wears away while grinding the bore of the cylinder, the stones will be moved transversely outward to compensate for this wear until they grind themselves free and the tension on the take-up spring 8 has become exhausted, at which time the stones may be again set up to the cylindrical surface and this spring again put under tension. Owing to the comparatively low or flat angle of the cam or wedge surface of the cones the same cannot be shifted relatively to each other lengthwise of the tool and reduce the diameter of the stones by inward pressure of the stone holders against the cones.

The tool upon being rotated and reciprocated while the stones are thus engaged with the bore of the cylinder will remove stock from the latter by the grinding action of the stones until the latter have freed themselves at which time the

adjusting screw is again tightened for again engaging the stones firmly with the bore of the cylinder and resuming removal of stock therefrom, this operation being repeated until the desired amount of stock has been removed or the predetermined diameter has been reached.

If the bore of the cylinder is perfectly true or parallel sided, the stone holders are moved transversely to the same extent at opposite ends thereof to maintain them parallel with the axis of the tool. If, however, the bore of the cylinder is more or less tapering in form one end of the stone holders will be moved inwardly toward the axis of the tool and the other end will be moved outwardly from said axis so that the stones will be tilted lengthwise sufficiently to properly engage the tapering bore of the cylinder. During such adjustment of the stone holders the guide pins at one end of the holders will exert a wedge action on one of the cones and shift the latter lengthwise in one direction by sliding of the respective pins toward the small end of this cone while the other cone will move in the same direction and engage its gradually enlarging part with the guide pins at the other ends of the stone holders and thereby spread the same to conform to the shape of the cylindrical bore which is being ground.

Although this diameter adjusting means is free to float lengthwise for automatically adapting the stones to cylindrical, tapering or irregular surfaces and the same are also capable of adjustment for adapting the stones to grind surfaces of various diameters, the stones are nevertheless prevented from moving away from the surface which is being ground due to the cones being substantially rigid so far as contraction under pressure against the face of the stones is concerned, thereby compelling the surfaces to conform to the diameter of the tool. Rocking or tilting of the holders is possible due to fitting the pins 17 sufficiently loose in the guide openings 12 for this purpose.

Heretofore the guiding means for the stone holders were so constructed that the center of the guiding means for each stone moved transversely of the tool body along a true radial line from the axis of rotation of the tool, whereby the face of each stone extended sidewise and engaged the bore of the cylinder equal distances from the longitudinal center of the same. For example, in the structure heretofore known and shown in Fig. 7, the stone holder 151 had a guide pin 171 sliding in a transverse guideway 121 on the tool body 91, the center line 331 of which registered exactly with a radial line through the axis of the body 91, cone 231 and screw 241, whereby the front lead or advancing corner 281 and the heel or rear trailing corner 291 of the outer face 30 of the stone engaged equally against the bore of the cylinder and also equidistant from the longitudinal center of the stone. Upon turning the tool clockwise in such a construction any loose fit which is usually present between the guide pins 171 and the guide opening 121 in the body 91 will cause the stone to be tilted transversely by turning each of the pins 171 on a fulcrum 172 located on the radial line 331 midway between the outer and inner ends of the respective guideway 121, whereby the front lead or advancing corner 281 of the stone will be carried outwardly to a greater extent, as indicated to an exaggerated degree by the dotted line 311 in Fig. 7, and thereby subject the stone to an excessive strain and incurring the liability of breaking away the front corner of the stone face and possibly other parts thereof, and also scoring the cylinder being ground, which is not only wasteful but also impairs the quality of the work or delays proper grinding of the same.

In the improved organization, best shown in Fig. 6, for internal cylinder grinding the guide pins 17 for each stone holder are arranged to slide transversely toward and from the axis of the tool along a center line 321 which is slightly in advance of the radial line 331 from the axis of the body of the tool.

By thus advancing the center of the line of transverse movement of the stone, holder and guide pins of each abrasive unit beyond a radial line 331 of the axis of the tool any slight backward tilt of the guide pins 17 in the guide openings 12 due to a working clearance between the same, will cause the respective guide pin 17 to turn about a fulcrum 34 which is slightly in advance of a radial line from the axis of said cone, the tool body and parts associated therewith and midway between the outer and inner ends of the openings 12 in the body 9, as shown in Fig. 6. Moreover, this manner of mounting the stone holders on the body has a tendency to slacken the tool to a certain extent and permit the face of the stones to free themselves from the surface being ground inasmuch as the work has a tendency at times to creep ahead of the stone and then the inner end 19 of each guide pin 17 again works itself back into its normal position on the high part of the respective cone.

It follows from this that the rearward circumferential tilt of the stone about the fulcrum point 34 will cause the front or advancing corner 28 of the stone to swing through a curved path which is more nearly concentric with the inner surface or bore of the cylinder, and that the rear or trailing corner or heel 29 of the stone is moved inwardly and a substantial clearance is produced between the same and the cylinder wall being ground, as shown in Fig. 6. The liability of breaking away any part of the face of the stone, particularly the front corner of the same, is therefore eliminated and the possibility of scoring the cylinder bore is reduced to a minimum, thereby increasing the life of the stones and producing superior work rapidly and at reduced cost.

By having the fulcrum about which each stone turns arranged slightly ahead circumferentially relatively to the axis of the body and the stone adjusting mechanism, the application of power for rotating the tool will cause the inner end of the pins 17 to swing ahead slightly about the fulcrum 34 and the stone will have a tendency to swing outward slightly in taking up any slack due to the loose fit of the guide pins 17 in the guide openings 12.

Although the position of this center line along which the guide pins, holders and stones move transversely in advance of radial lines of the tool may be varied to suit different sizes of tools and various kinds of work, it has been found satisfactory to locate each of these center lines of transverse movement twelve one-thousandths of an inch in advance of a radial line of the axis of the tool for those sizes of tools taking in all bores from two and three-quarters inches to four and one-quarter inches in diameter.

In practice the stones are first adjusted so that the front lead sharp corner engages with the bore of the cylinder being ground, thereby leaving a

clearance space at the heel or rear corner of the stone, as shown in Fig. 2. As the front corner of the stone wears during the grinding operation it will assume the cross sectional shape shown in Fig. 3 in which the stone tapers slightly from its heel to its lead. If the metal in the cylinder is not particularly hard the stones will continue to cut freely while engaging the cylinder with a full bearing, as shown in Fig. 3. However, if the metal is hard, after a full bearing of the stone is obtained, the stone with its supporting and guiding means should be reversed as a unit end for end on the body of the grinder so as to reverse the front lead and rear heel edges whereby the sharp cutting corner previously at the rear of the stone is now brought to the front and clearance is established between the former dull corner of the stone and the cylinder bore, as shown in Fig. 4.

The grinding operation may now be effectively continued until approximately two-thirds of the surface of the stone face is bearing on the bore of the cylinder, at which time a clearance is still maintained between the heel of the stone and the cylinder wall, as shown in Fig. 5. At this time the stone is again reversed end for end in the grinder and again thereafter whenever a two-thirds bearing of the stone is reached, thereby automatically dressing the stone to obtain a sharp front edge and eliminating the necessity of effecting this dressing by hand. Moreover such automatic dressing utilizes this function for doing useful work and effecting a saving in time and material accordingly.

By thus keeping the stones sharp constantly there is no drag at the heel of the stone, and it is possible to remove the stock from the cylinder with the expenditure of less power and it also permits of using finer stones.

Moreover, by setting each stone ahead of the center line of the tool body as explained above, the stones tend to free themselves or move away from the surface being ground while operating, thereby producing an ideal grinding action instead of a rubbing action as has been the case heretofore.

This improvement is equally applicable to grinders for removing stock from the exterior of cylinders. As shown in Fig. 8 the periphery of a shaft or cylinder 35 to be ground is engaged by a stone or abrasive member 36 which is mounted on a tubular body 37 rotatable concentrically about said shaft. This stone is adjustable toward and from the axis of the tool and so mounted on the body thereof that the same upon starting to rotate the tool clockwise will be tilted backwardly slightly about the fulcrum 46 to the position shown in Fig. 8 and will engage its lead edge or advancing corner 38 with the peripheral surface of the cylinder on or nearly on a radial line 42 extending from the axis of the shaft 35 and body 37, and establish a clearance between the heel or trailing corner 39 of the stone and the shaft or cylinder. This is accomplished by arranging the guide opening 44 in the body 37 for the pin 41 which is connected with the holder 42 of the stone 36 so that the center line 40 of this stone is slightly in rear of the radial line 42 leading from the axis of the shaft 35 and the tool body 37.

In this reversed construction of grinding mechanism the guide openings 44 are preferably formed obliquely in the tool body 37 relative to a radial line from the axis thereof. A plurality of stones 36 are mounted in this manner in an annular row on the body 37 and the several stones may be adjusted transversely of the axis of the tool for varying the working diameter of the same by any suitable means such as the cam means shown in Figs. 1–6 which is typically represented in Fig. 8 by a cone 43 sliding in a longitudinal opening 45 in the body 37 and engaging with the outer end of the pin 41, and screw 47 adjustably connecting the cone 43 with an opposed cone similar to the construction shown in Fig. 1.

I claim as my invention:—

1. A grinder for cylindrical surfaces comprising a rotatable body having a longitudinal bore and transversely extending guide openings; a plurality of abrasive members arranged in an annular row around the exterior of said body; a plurality of holders each carrying one of said abrasive members; guiding means for said holders including transversely movable pins slidable transversely in said guide openings and engaging their outer ends with said holders; and adjusting means arranged in the bore of said body and engaging the inner ends of said pins; said pins being transversely movable along center lines arranged in advance of radial lines from the axis of said body.

2. A grinder for cylindrical surfaces comprising a rotatable body having a longitudinal bore and transversely extending guide openings; a plurality of abrasive members arranged in an annular row around the exterior of said body; a plurality of holders each carrying one of said abrasive members; guiding pins slidable transversely in said openings, and engaging their outer ends with said holders; adjustable cam means movable lengthwise in the bore of said body and engaging with the inner ends of said pins; said pins being slidable toward and from the axis of the body on lines arranged in advance of radial lines from the axis of said body and engaging said cam means in advance of radial lines from the axis of said body.

3. A grinder for cylindrical surfaces comprising a rotatable body having a longitudinal bore and transversely extending guide openings; a plurality of abrasive members arranged in an annular row around the exterior of said body; a plurality of holders each carrying one of said abrasive members; guiding pins slidable transversely in said openings and engaging their outer ends with said holders; adjustable cam means movable lengthwise in the bore of said body and engaging with the inner ends of said pins; said pins being slidable toward and from the axis of the body on lines arranged in advance of radial lines from the axis of said body and engaging said cam means in advance of radial lines from the axis of said body; and said cam means being free to float lengthwise on the body and permit said holders to tilt relative to the body for adapting the abrasive members to the surface being ground.

4. A grinder for cylindrical surfaces comprising a rotatable body having a longitudinal bore and transversely extending guide openings; a plurality of abrasive members arranged in an annular row around the exterior of said body; a plurality of holders each carrying one of said abrasive members; guiding pins slidable transversely in said openings and engaging their outer ends with said holders; adjustable cam means movable lengthwise in the bore of said body and engaging with the inner ends of said pins; said pins being slidable toward and from the axis of

the body on lines arranged in advance of radial lines from the axis of said body and engaging said cam means in advance of radial lines from the axis of said body, said cam means including opposed cones engaging the inner ends of said pins and adjustably and substantially rigidly connected to limit the contraction of said abrasive members and said cones being free to float to permit said abrasive members to tilt and adapt themselves to the surface being ground.

5. A grinder for cylindrical surfaces comprising a rotatable body having a longitudinal guideway and a transverse guideway, an abrasive member, a holder carrying said abrasive member, a transversely movable shifting member sliding in said transverse guideway and engaging one of its ends with said holder, and longitudinally movable cam adjusting means sliding in said longitudinal guideway and engaging the opposite end of said transversely movable shifting member, said transversely movable member being movable along a center line which is arranged circumferentially parallel with a radial line from the axis of rotation of said body.

6. In a tool of the character described, carriers having an abrading surface and mounted for expansion and contraction movements, means for successively adjusting said carriers predetermined extents during one complete grinding operation without removing the tool from the cylinder including expanding devices contacting said carriers and a stem rotatable to move said devices axially along said carriers, and means in addition to the adjusting means for holding the abrading surface of said carriers in cutting or effective abrading contact with the cylinder wall surface throughout the range of each successive adjustment including a spring yieldably urging said stem axially to tensionally engage said devices and carriers and said carrier abrading surfaces and the cylinder wall surface.

7. In a tool of the character described, a body, abrading means supported thereby, independent adjusting devices acting on said abrading means, actuating means for said devices including a rotatable adjusting member supporting said devices, and compression means yieldably pressing said member and devices axially relative to said body to prevent unauthorized movement of said member during operation of the tool.

8. In a tool of the character described, carriers having an abrading surface and mounted for expansion and contraction movements, means for successively adjusting said carriers predetermined extents during one complete grinding operation, including cone members against which said carriers are rigidly seated and a stem member supporting and moving said cone members, and means in addition to the adjusting means for yieldably pressing said stem member axially for yieldably pressing the abrading surface of said carriers in cutting or effective abrading contact with the cylinder wall surface throughout the range of each successive adjustment to materially increase the grinding operation for each adjustment.

9. In a tool of the character described, a rotatable frame, an abrading element having a comparatively broad face portion engageable with the cylinder wall surface, and means for supporting said abrading element in said frame for expansion and contraction movements in radial direction, the median line of said element in radial direction being disposed rearwardly, with respect to direction of rotation, of a tool radius line passing substantially parallel with said median line through said element.

10. In a cylinder grinding tool, a rotatable frame, an abrasive carrier having a body part extending radially and supported by said frame for radial adjusting movements, an abrading element supported by said carrier, and means for supporting said carrier with the center line of its body in radial direction offset rearwardly, with respect to direction of rotation, from a tool radius line passing substantially parallel with said center line through said carrier.

11. In a tool of the character described, a frame, means forming a plurality of radial passages in said frame, abrasive carriers mounted for expansion and contraction movements in said passages, said carriers having inner surfaces extending into the central portion of said frame, adjusting devices mounted in the central portion of said frame having surfaces upon which said carrier surfaces seat, means for adjusting said devices to expand and contract said carriers, and means for so positioning said carriers in said passages that their inner surfaces are seated upon said adjusting device surfaces to one side of the radially-directed median line of said carriers.

12. In a tool of the character described, a frame, abrasive carriers mounted in said frame for tool-expansion and tool-contraction movements, said carriers being of sufficient dimension in radial direction to extend into the central portion of said frame and having inner surfaces, adjusting means mounted in the central portion of said frame and including elements having surfaces upon which the inner surfaces of said carriers seat, the mounting for said carriers being so positioned with respect to the tool radius that the median line in radial direction of each carrier is offset from a line passing through the exact center of the tool.

13. In a cylinder grinding tool, a frame, an abrasive carrier mounted therein and extending in radial direction with its median line in radial direction offset laterally from the tool radius and its inner edge projected adjacent the axis of the tool, means supporting said carrier for expansion and contraction movements, adjustable means engaging the inner edge of said carrier to one side of its said median line for expanding said carrier, and carrier-contracting means normally holding said carrier and adjustable means engaged.

14. In a tool of the character described, a rotatable frame, an abrasive element having a working face portion engageable with the cylinder wall surface, and means for supporting said abrasive element in said frame so that a major portion of said working face will be positioned rearwardly, with respect to the direction of rotation, of a tool radii passing through the element in parallelism with the central radial plane of the element.

15. In a tool of the character described, a body constructed and arranged to provide a center space with radially-directed slideways leading thereinto, each of said slideways having its median line offset from a tool radius line, carrier members snugly and slidably mounted in said slideways, means located in said center space and engaged with said carrier members for adjusting said carrier members outwardly to expand the tool, and means for actuating said last-named means to effect said adjustment.

16. In a tool of the character described, a body constructed and arranged to provide a center

space with radially-extending slideways leading thereinto, each of said slideways having its median line offset from a tool radius line but arranged parallel thereto, carrier members snugly and slidably mounted, respectively, in said slideways, means located in said center space and engaging with said carrier members for adjusting said carrier members outwardly to expand the tool, means for actuating said last-mentioned means to effect said adjustment, and means for moving said carrier members inwardly to contract the tool.

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