Nov. 20, 1934. P. E. WAGNER 1,981,258

TOOL FOR GRINDING OR LAPPING CYLINDRICAL BORES

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FIG. 1.

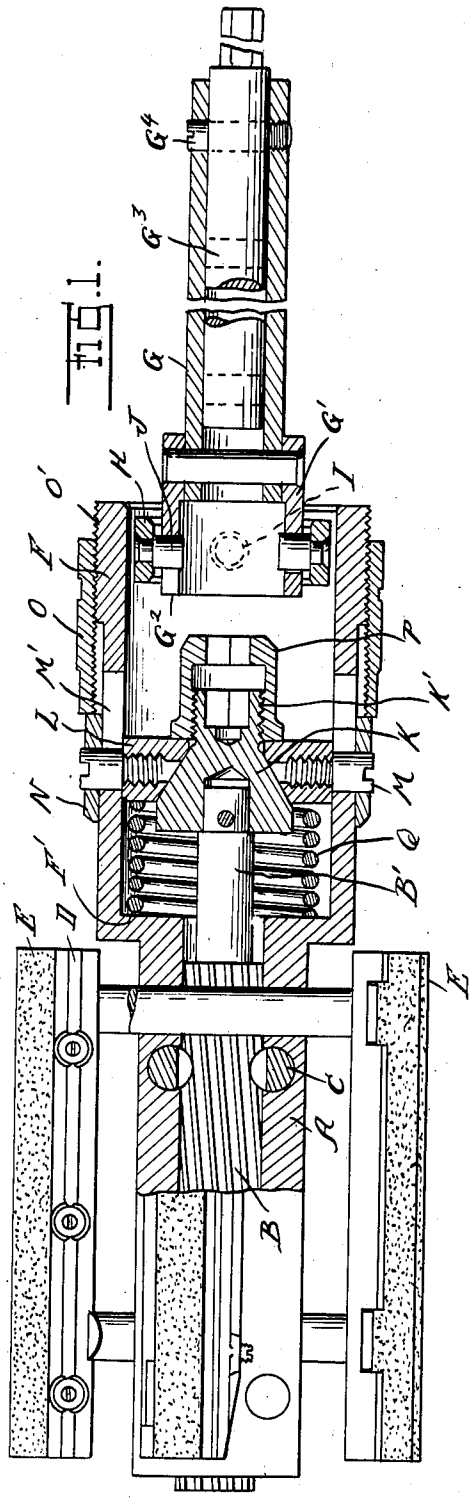


FIG. 3.

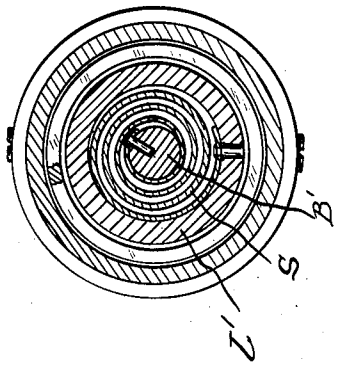
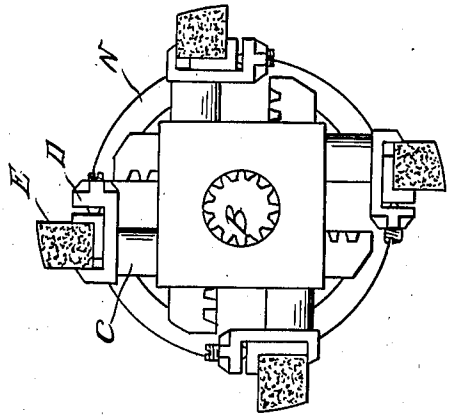


FIG. 2.



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FIG. 4.

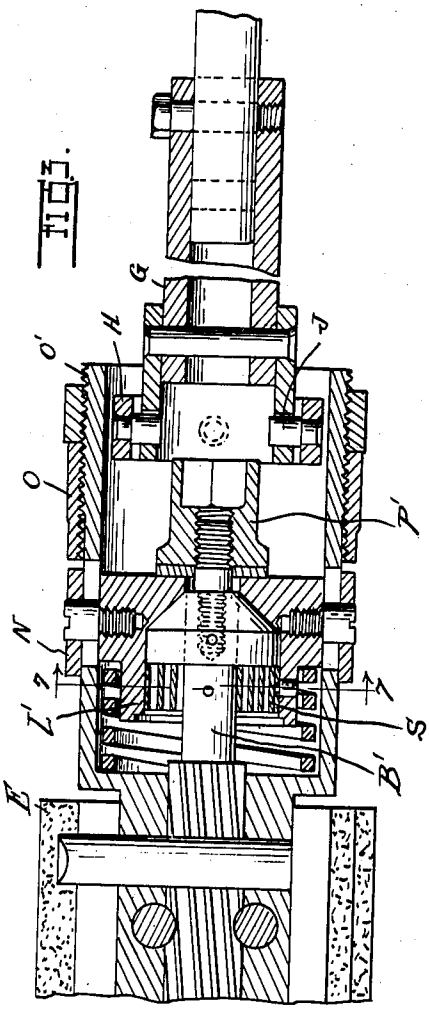
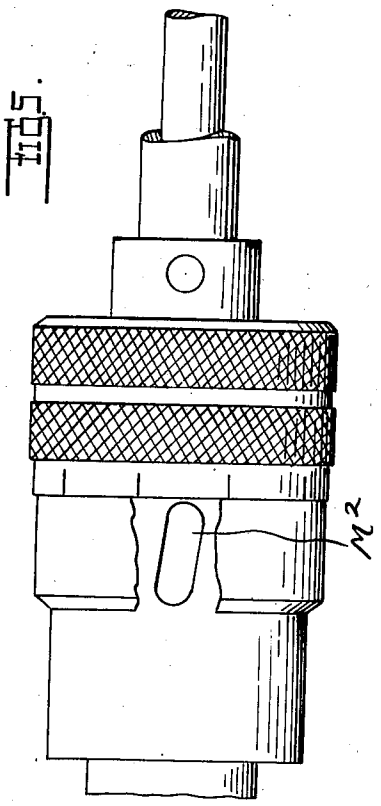


FIG. 5.



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Fig. 4.

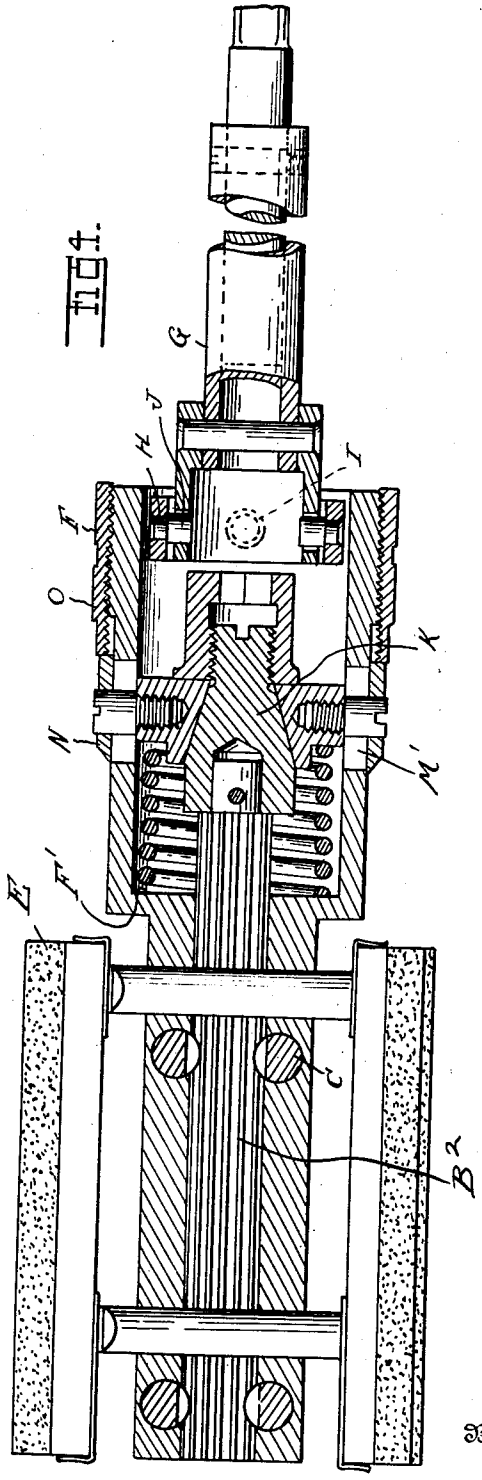
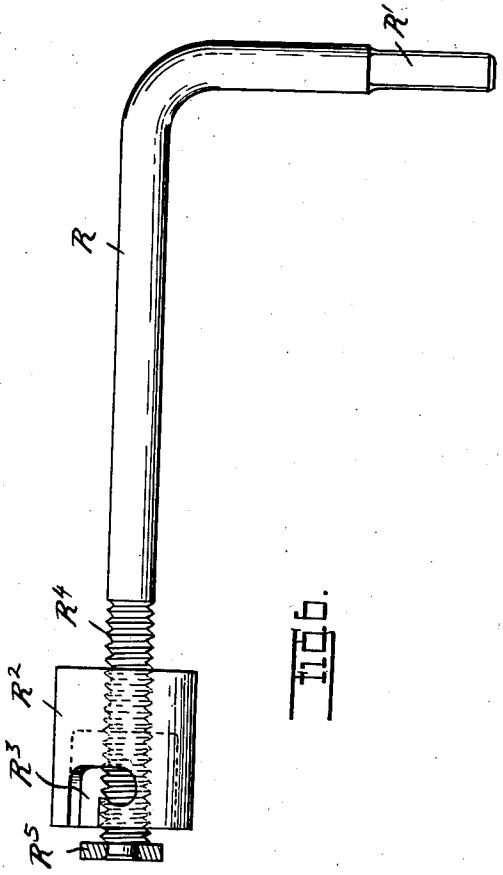


Fig. 6.



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UNITED STATES PATENT OFFICE

1,981,258

TOOL FOR GRINDING OR LAPPING CYLINDRICAL BORES

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Application February 15, 1932, Serial No. 593,148

12 Claims. (Cl. 51—184.1)

The invention relates to the art of finishing and rectifying irregularities in cylindrical bores by a process commonly known as honing, grinding or lapping and which employs a rotary and axially reciprocatory tool carrying the abrading members. In the present state of the art tools of this character usually include a series of holders for the grinder bars which are mounted upon a rotary and reciprocatory shank and are also provided with mechanism for adjusting them radially outward into operative relation to the bore which is to be ground. This adjusting mechanism is usually manually operated and therefore during the performance of the work it is necessary from time to time to make further manual adjustment until the finished dimension of bore is attained. Care and skill must be exercised by the workmen in making these adjustments to avoid on the one hand too great pressure which would have the effect of needlessly breaking down or wearing away the abrasive element and on the other hand, to maintain sufficient pressure for effective grinding action.

It is the object of the present invention to obtain a construction of tool which when in use will automatically maintain a predetermined pressure upon the surface being ground. It is a further object to accurately limit the expansion of the tool so as to avoid grinding the bore over size. With these and other objects in view the invention consists in the construction as hereinafter set forth.

In the drawings:

Figure 1 is a central longitudinal section through my improved tool;

Figure 2 is an end elevation thereof;

Figure 3 is a view similar to a portion of Figure 1 showing a modified construction;

Figure 4 is a view similar to Figure 1 showing another modified construction, and

Figure 5 is a side elevation of a portion of the construction shown in Figure 4;

Figure 6 is an elevation of a wrench used in adjusting the tool;

Figure 7 is a section on line 7—7 of Figure 3.

My improvement may be applied to various specific constructions of tool but as illustrated, A is a hollow core member within which is arranged an elongated gear wheel or pinion B engaging rack bars C which extend through transverse apertures in the core and which at their outer ends are connected to holders D for the abrasive bars E. The rack bars C are arranged in pairs engaging the gear wheel B at different points in its periphery, each pair being connected, at the opposite ends, to the holder D and the arrangement being such that a rotation of the gear wheel in one direction will simultaneously and correspondingly move outward all of the abrasive members to expand the diameter of the tool.

The outer end portion F of the core A is preferably enlarged in diameter and has connected thereto suitable means for imparting rotary motion. As shown, this comprises a rotary shaft G extending into the outer end of the portion F and connected thereto by a universal joint H. The shaft G can be driven by an electric hand drill or any other suitable drive mechanism and the universal joint permits the shank A to float and to align itself with the axis of the cylinder being ground. To permit of readily attaching and detaching the shaft G the universal joint is in the form of a ring having pivot pins I connecting the same with the member F and inwardly extending pivot pins J at right angles to the pins I. The shaft is detachably engaged with the pins J through the medium of a sleeve G′ having angle slots G^2 therein for forming a bayonet lock with the pins. The shaft G is also preferably provided with an extensive portion G^3 adjustably secured by means of a screw pin G^4.

As has been stated, it is one of the objects of my invention to provide automatic means for feeding the abrasive members outward during the grinding or honing operation. It is also necessary to provide means for adjusting the tool to bores of different diameters which is accomplished in my improved construction as follows: The gear wheel B has a shank B′ extending into the chamber within the enlargement F of the member A and has mounted thereon a conical clutch member K for engaging a cooperating clutch member L slidably fitting within said enlargement F. This member L has pins M projecting outward therefrom on diametrically opposite sides which pins engage longitudinal slots M′ in the member F and project outward beyond the same. N is a collar slidably engaging the outer surface of the member F and apertured to receive the pins M, and O is a second collar internally threaded and engaging an externally threaded portion O′ of the member F to be longitudinally adjustable thereon. The clutch members K and L are normally locked to each other by a nut P which engages a threaded shank K′ of the member K and bears against the member L. Both the nut and the shank K′ have polygonal recesses therein for receiving a wrench for adjusting the same. Thus when the nut P is loosened the members K and B may be rotated to adjust the abrasive members E to fit the bore,

but when the nut P is tightened the assembled members B, K and L are held from movement other than that permitted by the travel of the pins M in the slots M'.

The automatic feeding during the grinding operation may be effected in several ways. As shown in Figures 1 and 3, it is accomplished by making the gear wheel B slightly helical so that a longitudinal or axial movement of the same without rotation will cause an outward or inward movement of the rack bar C, dependent upon direction of said longitudinal movement. On the other hand, as shown in Figures 4 and 5, the gear wheel B^2 may have its teeth parallel to the axis but the slots M^2 are slightly inclined to that axis so that during axial movement of the assembly B, K and L the gear wheel will be slightly rotated to effect an outward or inward movement of the rack members C. With each construction the motive power for the outward movement is a spring Q, one end of which bears against a member L and the other against an abutment shoulder F'. This spring is so tensioned as to transmit through the members L, K, B and C the desired outward pressure against the abrasive members E for effective grinding.

With the construction as thus far described, the operation of the tool is as follows: The operator first inserts the tool within the bore to be ground or honed and then adjusts the abrasive members E outward to fit the portion of smallest diameter. This operation may be accomplished by the use of a wrench R which has a polygonal portion R' for fitting the polygonal recesses in the nut P and shank K'. The wrench is first inserted to engage the nut only and then turned to loosen the same after which it is inserted into the shank K' and turned to rotate the pinion B and move the rack C outward. When properly adjusted the wrench is withdrawn from the shank K' and is turned to tighten the nut so as to clamp the parts in this position. The operator then adjusts the collar O on the threaded portion O' of the member F to space said collar from the collar N. The amount of this adjustment is determined by the size of the finished bore required and the outer surface of the collar may be suitably calibrated to facilitate the adjustment. The operator next couples the shaft G by engaging the pins J with the slots G^2 in the sleeve G' after which rotary motion is imparted through an electric drill or any suitable driving means. At the same time a reciprocatory longitudinal movement is given to the tool either manually or by mechanism.

Where the tool is used for grinding or honing successive cylinders, all of which are to be finished in the same diameter, I have provided means for retracting the abrasive members E without disturbing the adjustments. This is accomplished by a suitable tool which may be formed on the opposite end of the wrench R and which comprises a sleeve R^2 having bayonet slots R^3 therein for engaging the pins J, said sleeve having a threaded engagement with a portion R^4 of the member R. At the end of the portion R^4 is a head R^5 which when the sleeve R^2 is locked to the pins J can be pressed against the outer end of the nut P by the rotation of the member R and the screwing of the same downward in the sleeve R^2. This will move the whole assembly P, L, K and B longitudinally against the pressure of the spring Q and will thereby retract the racks C and abrasive members E carried thereby. The tool may then be withdrawn from the finished bore and inserted in a new bore to be ground or honed, whereupon the wrench R is detached and the operation is repeated.

With the modified construction shown in Figure 3, I have provided automatic means for initially adjusting the tool to fit the bore which is to be ground. This comprises a spiral torsion spring S which is arranged within a sleeve extension L' of the member L and has one end attached thereto. The other end of the spring is attached to the shank B' so that when the spring is properly tensioned and when the clutch members K and L are released, the gear wheel B will be rotated. With this construction the operator first releases the nut P' and then by pressing inward upon the abrasive members E can contract the diameter of the tool to a size that will permit insertion of the same in the bore. The members E are then released and will be automatically adjusted outward through the operation of the spring S to fit the smallest diameter of the bore after which the nut P' may be tightened. The automatic feeding will then follow as previously described.

It will be noted that the mechanism for automatically feeding the abrasive members outward is irreversible so that the said members are unyielding to any external pressure thereagainst, regardless of how light the pressure may be for urging them outward. This permits of tensioning the spring so that a predetermining outward pressure is placed on the abrasive members, this being the best adapted for the performance of the work.

What I claim as my invention is:

1. In a tool for grinding or honing cylindrical bores, the combination with a rotary and axially reciprocatory core, a plurality of abrasive members mounted on said core and reversible mechanism for adjusting said abrasive members radially to set the same in operative relation to the surface to be ground, of means for locking said mechanism in its adjusted position, irreversible automatic mechanism for further radially expanding said abrasive members, resilient means for operating said irreversible automatic mechanism to place a predetermined outward pressure on said abrasive members and an adjustable stop for limiting movement of said irreversible automatic mechanism and the expansion of the abrasive members thereby.

2. In a tool for grinding or honing cylindrical bores, the combination with a hollow core member, of an elongated gear member within said core member, a series of rack bars extending transversely through said core member in operative relation to said gear, abrasive members carried by said rack members to be moved radially outward or inward, a member longitudinally slidable in said hollow core member, a clutch for locking said gear member to said slidable member, a spring within said hollow core member engaging said slidable member to actuate the same, whereby the longitudinal movement of said slidable member under the actuation of said spring will actuate said rack bars to further radially expand said abrasive members.

3. In a tool for grinding or honing cylindrical bores, the combination with a hollow core member, of an elongated gear member within the core member having the teeth thereof slightly spirally inclined to the axis, a series of rack bars extending transversely through said core member in operative relation to said gear, abrasive members carried by said rack members to be moved radially outward or inward, a member carrying said gear member slidable within said hollow core

member, a collar longitudinally slidable on the outer surface of said core member, a pin connecting said collar and said member within said core member, said pin passing through a longitudinal slot in the wall of said core member, and a spring engaging said slidable member within said core member to actuate the same in an axial direction whereby the spiral angle of the teeth of said gear member will transmit a radially outward pressure to said rack members and to the abrasive members carried thereby.

4. In a tool for grinding or honing cylindrical bores, the combination with a core member, a plurality of abrasive members mounted thereon and mechanism including a rack and gear for moving said abrasive members radially with respect to said core member, of actuating means for rotating said gear member, a member slidable within said hollow core member, a nut for clamping said gear actuating means to said slidable member, pins connecting to said slidable member passing outward through longitudinal slots in said core member, a collar slidable on the outer face of said core member engaging said pins, a second collar longitudinally adjustable on said core member to form a variably positioned stop for limiting longitudinal movement of said first collar, a spring within said hollow core member engaging said slidable member to move the same and said pins and collar towards the limiting stop, the teeth on said gear member being slightly inclined to the axis thereof to form an automatically irreversible transmission between said spring and said abrasive members and to maintain a predetermined radial cutward pressure thereon.

5. In a tool for grinding or honing cylindrical bores, the combination with a core member, a plurality of abrasive members mounted thereon and reversible mechanism for moving said abrasive members radially inward and outward, means for actuating said reversible mechanism to adjust said abrasive members into operative relation to the surface to be ground, means for locking said reversible mechanism from movement when thus adjusted, an automatically irreversible mechanism for actuating a portion of said reversible mechanism to further radially expand said abrasive members, resilient means for operating said irreversible mechanism to transmit a predetermined outward pressure to said abrasive members, a stop for arresting movement of said irreversible mechanism, and means for retracting said irreversible mechanism against the tension of said spring.

6. In a tool for grinding or honing cylindrical bores, the combination with a rotary and axially reciprocating core, a plurality of abrasive members mounted on said core and reversible mechanism for adjusting said abrasive members radially to set the same in operative relation to the surface to be ground, of resilient means for automatically operating said mechanism to move said abrasive members outward, means for locking said mechanism in its adjusted position, automatically irreversible mechanism for further radially expanding said abrasive member, resilient means for operating said irreversible mechanism to place a predetermined outward pressure on said abrasive members and an adjustable stop for limiting movement of said irreversible mechanism and the expansion of the abrasive members thereby.

7. In a tool for grinding or honing cylindrical bores, the combination with a rotary and axially reciprocatory core, a plurality of abrasive members mounted on said core and reversible mechanism for adjusting the abrasive members radially to set the same in operative relation to the surface to be ground, of resilient means for actuating said mechanism to move said abrasive members outward, means for locking said mechanism in its adjusted position, autcmatically irreversible mechanism for further radially expanding said abrasive members, resilient means for operating said irreversible mechanism to place a predetermined outward pressure on said abrasive members, an adjustable stop for limiting movement of said irreversible mechanism and the expansion of the abrasive members thereby, and means for retracting said irreversible mechanism to permit of movement away from said stop and the ccntraction of said abrasive members for engagement with another bore to be ground.

8. In a tool for grinding or honing cylindrical bores, the combination with a hollow core member, of an elongated gear member within said core member, a series of rack bars extending transversely through said core member in operative relation to said gear, abrasive members carried by said rack members to be moved radially outward or inward thereby, a member longitudinally slidable in said hollow core member, a clutch for locking said gear member to said slidable member, a spring within said hollow core member engaging said slidable member to actuate the same in a longitudinal direction, and means for guiding said longitudinally slidable member in a slightly helical path to impart a rotation to said gear member and to actuate said rack bars to further radially expand said abrasive members.

9. In a tool for grinding or honing cylindrical bores, the combination with a hollow core member, of an elongated gear member within the core member, a series of rack bars extending transversely through said core member in operative relation to said gear, abrasive members carried by said rack members to be moved radially outward or inward, a member slidable within said hollow core member, a collar longitudinally slidable on the outer surface of said core member, a pin connecting said collar and said member within said core member, said pin passing through a longitudinal slot in the wall of said core member slightly inclined to the longitudinal axis, and a spring engaging said slidable member within said core member to actuate the same in an axial direction whereby the pressure of said spring and the inclination of said slot will transmit a radially outward pressure to said rack members and the abrasive members carried thereby.

10. In a tool for grinding or honing cylindrical bores, the combination with a core member, a plurality of abrasive members mounted thereon and reversible mechanism for moving said abrasive members radially inward and outward, resilient means for automatically actuating said reversible mechanism to move said abrasive members in an outward direction into operative relation to the surface to be ground, means for locking said reversible mechanism when thus adjusted, irreversible mechanism for actuating a portion of said reversible mechanism to further radially expand said abrasive members, resilient means for operating said irreversible mechanism to transmit a predetermined outward pressure to said abrasive members, a stop for arresting movement of said irreversible mechanism, and means for retracting said irreversible mechanism against the tension of said spring.

11. In a tool for grinding or honing cylindrical bores, the combination with a rotary and axially reciprocatory hollow core and a plurality of abrasive members mounted on said core, of a reversible mechanism including an elongated gear member within said core member, a series of rack bars extending transversely through said core member in operative relation to said gear, said abrasive members being mounted at the outer ends of said rack bars, a spiral torsion spring for automatically actuating said gear member in a direction to move said abrasive members outward into operative relation to the surface to be ground, means for locking said reversible mechanism from further movement under the actuation of said spring, and automatically irreversible mechanism for adjusting said abrasive members further outward.

12. In a tool for grinding or honing cylindrical bores, the combination with a core member, a plurality of abrasive members mounted thereon and reversible mechanism for moving said abrasive members radially inward and outward including a gear wheel and rack bars actuated thereby, of a spiral torsion spring for automatically actuating said gear wheel in a direction to move said abrasive members outward into operative relation to the surface to be ground, means for locking said reversible mechanism from further movement under the actuation of said spring and automatically irreversible mechanism for actuating a portion of said reversible mechanism to further radially expand said abrasive members, resilient means for automatically operating said irreversible mechanism to transmit a predetermined outward pressure to said abrasive members, a stop for arresting movement of said irreversible mechanism and means for retracting said irreversible mechanism against the tension of said spring.

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