May 8, 1934. H. W. ZIMMERMAN 1,957,485

CYLINDER GRINDING TOOL ADJUSTING MECHANISM

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Fig. 1.

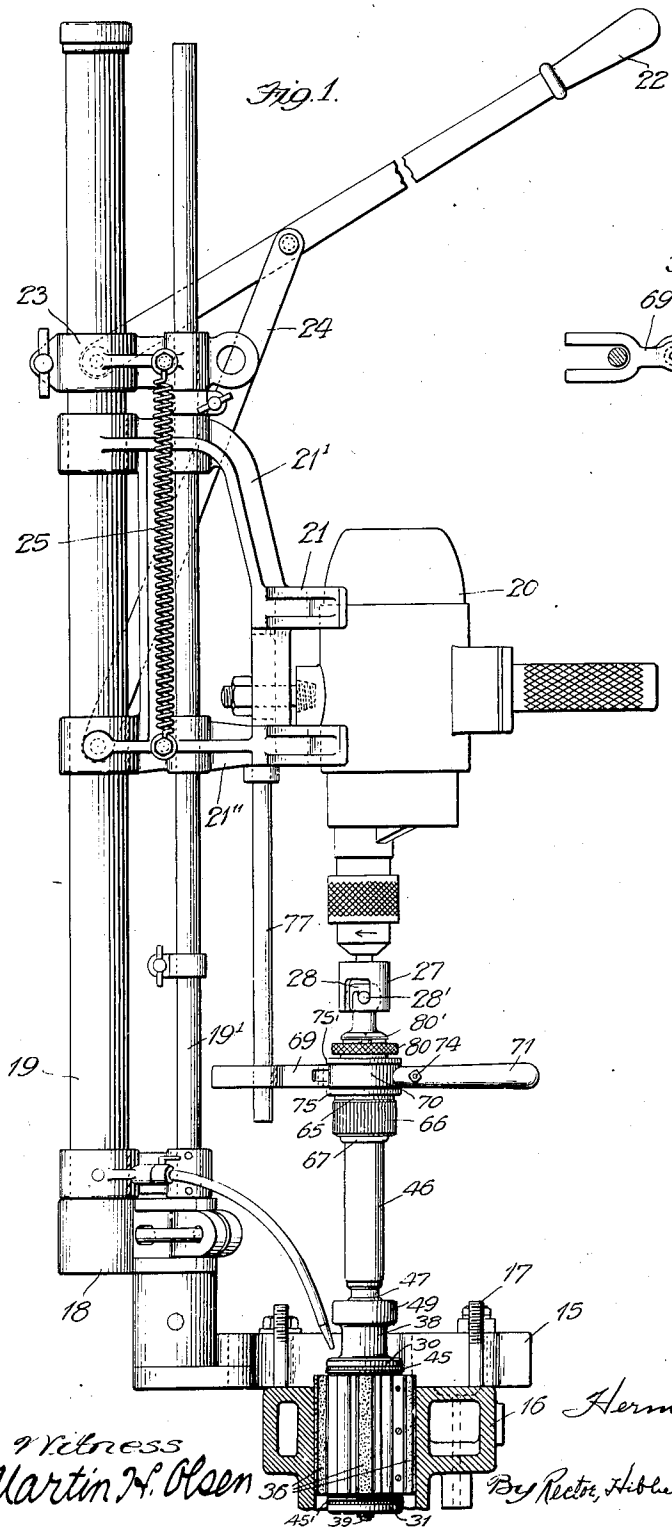
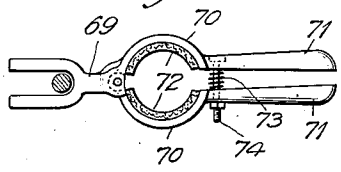


Fig. 12.



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Fig. 2.

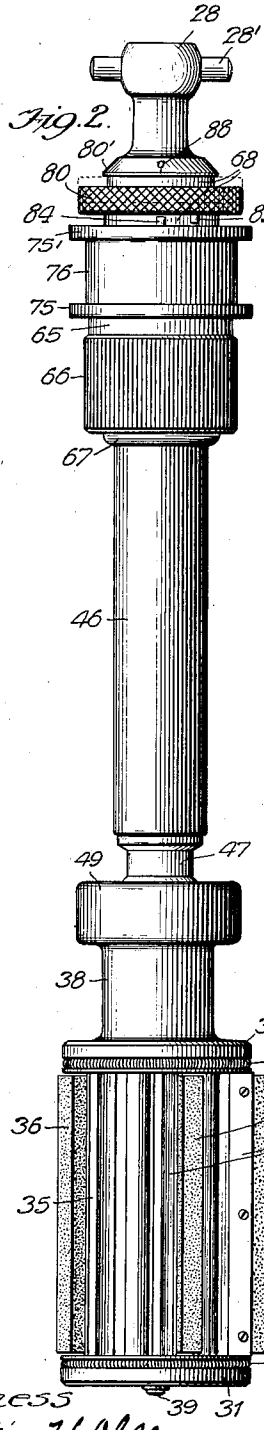


Fig. 3.

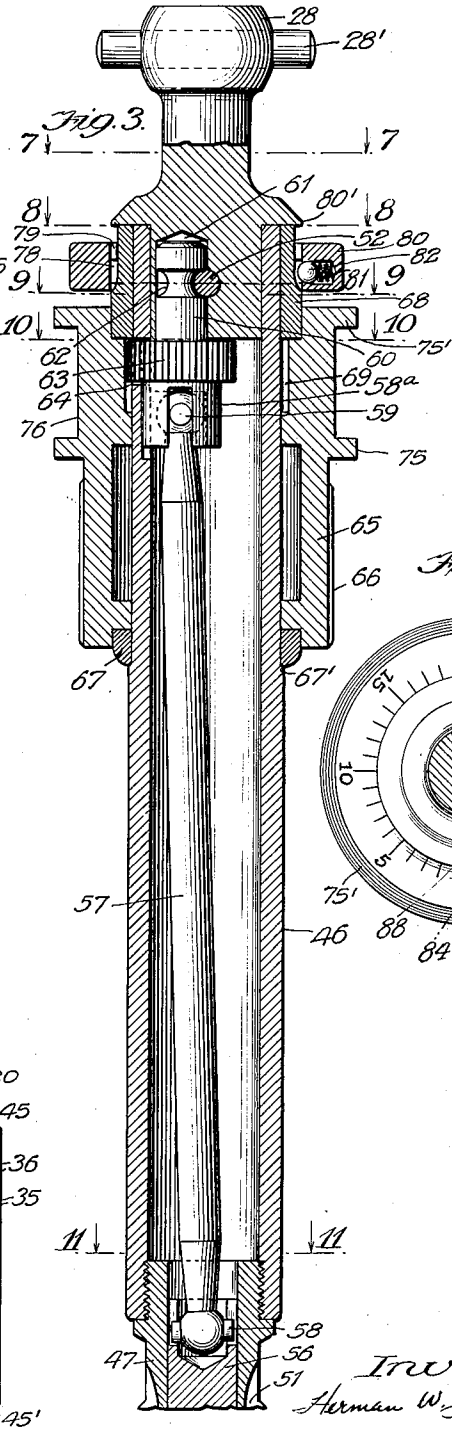
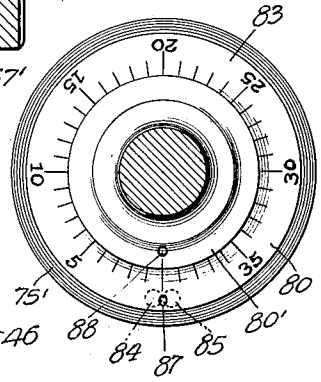


Fig. 7.



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Fig. 4.

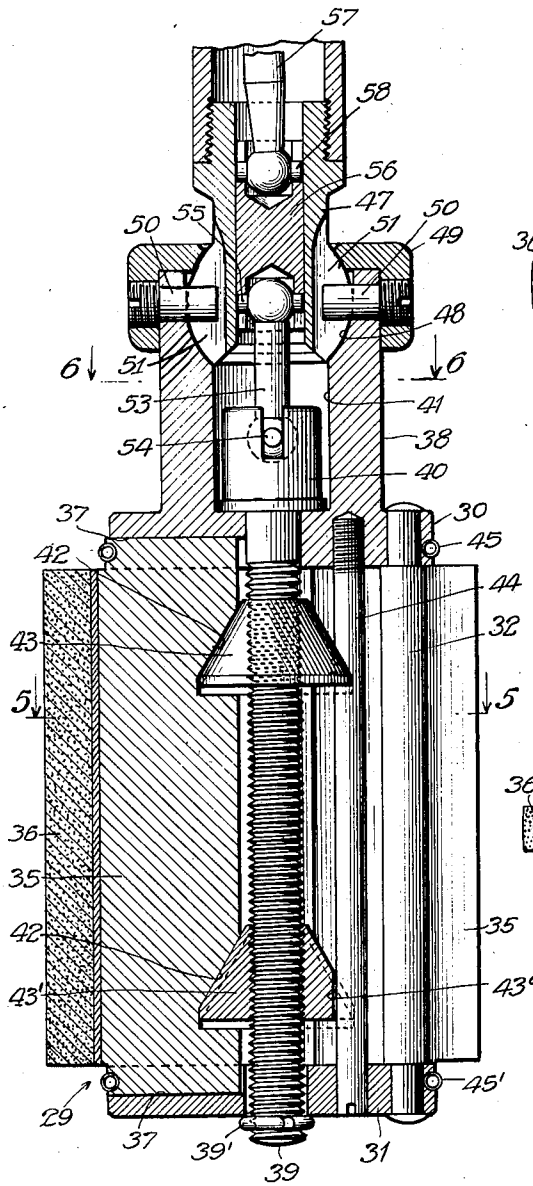


Fig. 5.

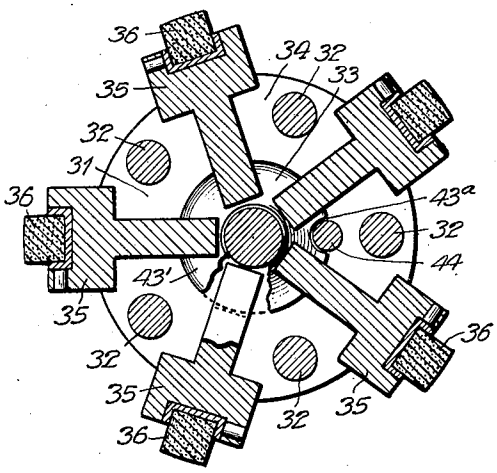
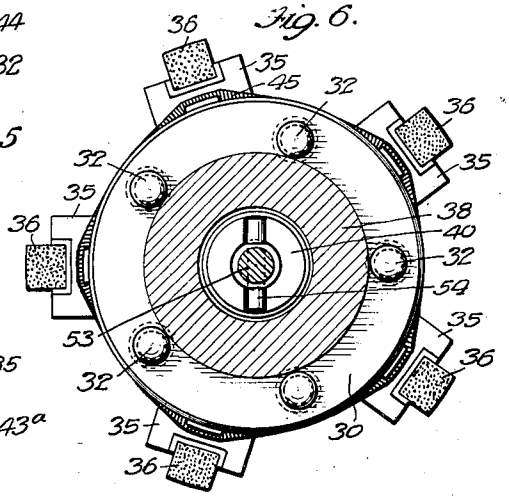


Fig. 6.



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Fig. 8.

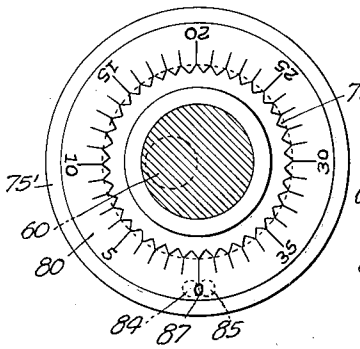


Fig. 9.

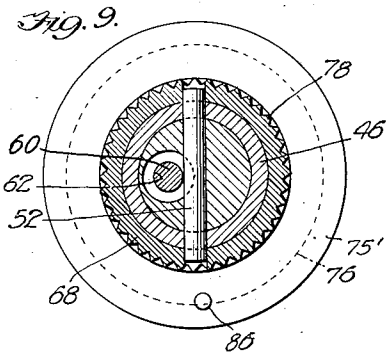


Fig. 10.

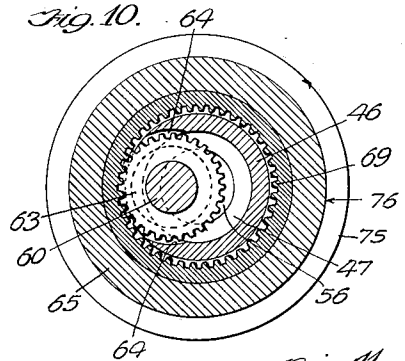


Fig. 11.

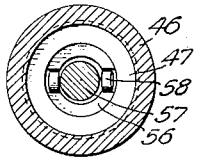


Fig. 13.

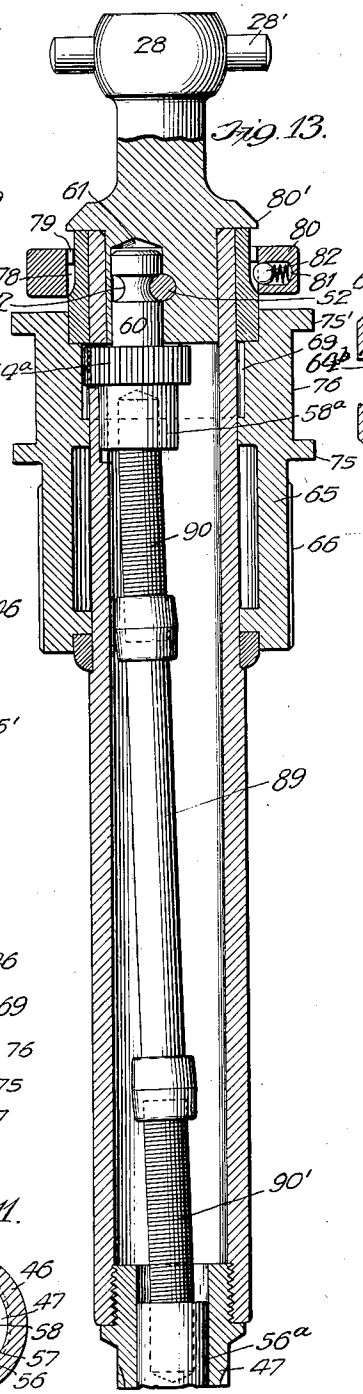
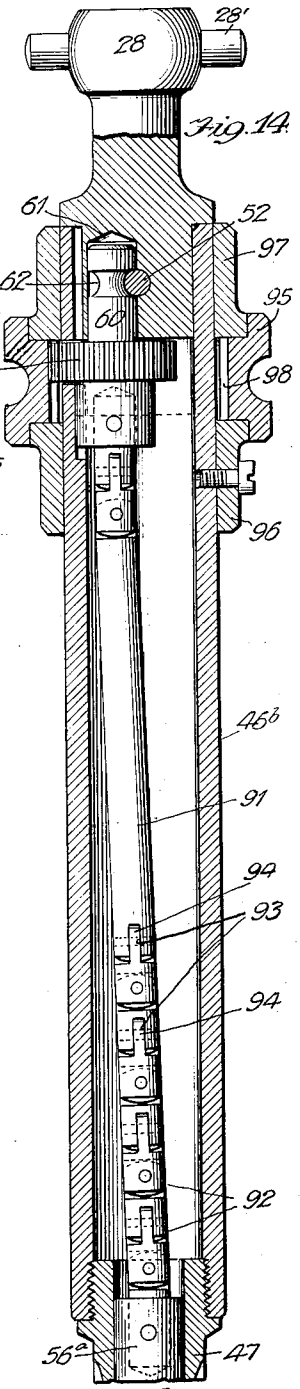


Fig. 14.



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Patented May 8, 1934 1,957,485

UNITED STATES PATENT OFFICE

1,957,485

CYLINDER GRINDING TOOL ADJUSTING MECHANISM

Herman W. Zimmerman, Chicago, Ill., assignor to Automotive Maintenance Machinery Co., Chicago, Ill., a corporation of Illinois

Application November 2, 1928, Serial No. 316,696

16 Claims. (Cl. 51—34)

My invention relates generally to a tool for grinding the bores of engines, pumps, or other cylinders either in factory production-work or in the reconditioning of worn cylinders, and it has to do more particularly with mechanism for adjusting the abrading stones of such tool whereby the cylinder cavity surface may be ground with true cylindricity to the desired accurate diameter and smooth finish.

One of the objects of my invention is to provide a simple and inexpensive adjusting mechanism of the foregoing character which enables the operator to adjust the grinding stones easily and quickly with a minimum of effort and a high degree of accuracy from time to time without removing the tool from the cylinder bore and without breaking the connections between the tool and the drive means.

Another object is to provide for adjustment of the abrading stones wthout stopping the grinding operation.

An additional object is to provide mechanical means for accurately defining and limiting the extent of the grinding operation on each cylinder, regardless whether the adjustment be made while the tool is in motion or when it is stopped, whereby a plurality of cylinders may be ground quickly and to substantially the same extent.

A further and more specific object is to provide adjusting mechanism adapted for the carrying out of the foregoing features by which the grinding stones may be adjusted from a point considerably remote from the cylinder.

Other objects are to provide a tool which is of rugged construction and highly efficient in functioning; to insure that any adjustment of the grinding stones which the operator may make will be maintained during the grinding operation and until the operator intentionally changes the same; to provide for free adjustment of the grinding stones while the tool is in the cylinder regardless of disalignment of the tool and its driving connections; and to practically eliminate the need of skilled labor in the grinding of cylinders.

Other objects and advantages will become apparent as this description progresses and by reference to the drawings wherein,—

Figure 1 is a side elevational view, partially in section, showing one form of cylinder grinding apparatus embodying my invention and showing a cylinder to be ground;

Fig. 2 is an enlarged elevational view of the grinding tool and its drive connection;

Fig. 3 is an enlarged vertical section through the upper part of the driving and adjusting connections of the structure shown in Fig. 2;

Fig. 4 is an enlarged vertical section through the grinding tool and showing part of its driving and adjusting connection;

Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 4;

Fig. 6 is a horizontal sectional view taken on line 6—6 of Fig. 4;

Fig. 7 is a horizontal section taken on line 7—7 of Fig. 3;

Fig. 8 is a horizontal section taken on line 8—8 of Fig. 3;

Fig. 9 is a horizontal section taken on line 9—9 of Fig. 3;

Fig. 10 is a horizontal section taken on line 10—10 of Fig. 3;

Fig. 11 is a horizontal section taken on line 11—11 of Fig. 3;

Fig. 12 is a separated plan view, partially in section, of a friction clutch or brake structure associated with the tool adjusting mechanism;

Fig. 13 is a vertical section similar to Fig. 3 showing another form of adjusting mechanism embodying my invention; and

Fig. 14 is still another modified form of adjusting mechanism embodying my invention.

My invention is well adapted to a grinding tool of a type wherein the grinding stones are radially adjustable relative to the cylinder surface to be ground, but it is to be understood that it may also be of great utility in connection with any other form of cylinder grinding tool in connection with which similar adjustment problems exist.

In the drawings, I have chosen to illustrate my invention as applied to a tool of the radially-adjustable character. With particular reference to Fig. 1, I preferably employ a compound-adjustable supporting stand for the tool which includes a base part 15 fixed upon the cylinder 16 by suitable clamping devices 17. This base has mounted thereon a horizontally swingable arm 18 which, in turn, rotatably supports upright standards 19, 19'. A power device (which in this instance takes the form of an electric drill motor 20) is supported upon the standards 19, 19' by bracket device 21 having spaced arms 21' 21'' which have vertical sliding connection with the standards. Reciprocatory movement of the drill 20 is accomplished by a handle 22 pivotally connected at one end to an adjustable bracket 23. This handle has a link connection 24 with the drill support arm 21'', and movement of the drill 20 is cushioned and aided by a spring 25

anchored to the bracket 23 and to the slidable arm 21'' as clearly shown in the drawings. The drill drive connection 27 rotates in the direction indicated by the arrow in Fig. 1, and this connection is provided with a socket having a bayonet slot which receives the cross pin 28' carried by the upper drive head 28 to provide a drive connection between the power means and the grinding tool.

The particular form of grinding tool which I have chosen to illustrate my invention (Figs. 2, 3, 4, 5 and 6) comprises a cage-like frame 29 having top and bottom parts 30 and 31 joined together by a plurality of connecting rods 32 so as to provide a center space 33 and radial passages 34. Stone carriers 35 supporting abrading stones 36 are mounted in the radial passages 34, and these carriers are supported in their radial movements by tongue and groove provision, indicated generally at 37, in the end parts 30 and 31. The top part of this cage body 29 is extended upwardly providing a head 38 with which the driving and adjusting connections are associated as will be described more fully hereinafter.

Radial movements of the stone carriers 35 are effected as follows: A threaded stem 39 extends centrally through the center space 33 of the body and this stem is provided with an enlarged head 40 which is disposed in the longitudinal bore 41 of the tool head in such a way that the screw is free to rotate without longitudinal displacement with respect to the tool body (Fig. 4). The lower end of the screw 39 passes freely through an opening in the bottom body part 31 where it engages a snap ring 39' for a purpose which will be well understood. The inner edges of the stone carriers 35 are provided with sloped wedge surfaces 42 adapted to be engaged by a pair of complementally-shaped cone spreaders 43, 43' which are mounted upon the center stem 39. Rotation of these spreaders is prevented by means of a guide bar 44 carried by the body and parts and which engages suitably provided grooves 43^a in the cone spreaders (Figs. 4 and 5). It will be obvious that, with the foregoing construction, rotation of the center stem will cause the cone spreaders 43, 43' to move up or down (dependent upon the direction of rotation of the screw stem) to uniformly spread the stone carriers apart or to permit their retraction, and to this end, I may employ spring rings 45, 45' at the opposite ends of the tool body which constantly engage the stone carriers and firmly press them inwardly against the cone spreaders. This tool works very efficiently to maintain true cylindricity in its grinding and polishing operation, all parts being definitely maintained in proper alignment and position for effecting such operations.

When it is desired to grind a cylinder bore, the tool is inserted within such bore and the stone carriers are adjusted to bring the abrading stones 36 into the desired engagement with the cylinder wall surface. The tool is then rotated and, as this takes place, it becomes necessary to make adjustments of the stone carriers from time to time to bring the surface finally to the desired accurate diameter and finish. It is highly desirable from time-saving and cost standpoints that adjustment of the stone carriers be made without removing the tool from the cylinder, without breaking any of the drive connections, and with the least inconvenience to the operator. These factors also enter into the efficiency and accuracy of the tool as a whole.

It is further well known that wear in a cylinder takes place only along the surface within the limits of the ring travel. Because of this, practice has demonstrated that in the grinding of a worn cylinder, it is highly desirable that the grinding operation be started at the bottom of the cylinder surface where wear has not taken place. Such unworn surface provides at the beginning an accurate guide, and by starting the grinding at this point, a cylindrical surface in true alignment with the crank shaft is insured. It thus becomes highly desirable that the tool adjustment means be readily accessible to the operator regardless of what position the tool may assume in the cylinder.

My invention provides for the foregoing desirable features and, to that end, I provide an adjusting mechanism which is readily accessible to the operator at a point quite remote from the cylinder and which is, preferably, located adjacent the drill or power means 20. My adjusting mechanism is associated with a power shaft 46 (Figs. 2 and 3) which is hollow for the purpose which will now be described. The drive shaft 46 carries at its lower end a detachable parti-spherical head 47 (Fig. 4) which is snugly received for universal movement in a cylindrical socket 48 at the outer end of the bore 41 of the tool head. This shaft head is secured within the socket for universal movements by a suitably apertured cap 49 fitting over the upper part of the tool head and by diametrically opposed pins 50 carried by the tool head and projecting through its wall to engage diametrically opposed slots 51 in the shaft head. This arrangement permits of the desired rocking movements of the head relative to the tool, as well as fixing these parts together for rotary driving movement. The head 28 at the opposite end of the shaft 46 is fixedly secured thereto by a cross pin 52 (Figs. 3 and 9), and it will be obvious that upon rotation of the member 27, the tool will likewise be rotated in the cylinder 16. Disalignment between the tool proper and the driving means (drill 20 or whatever it may be) is compensated for by the above-described universal connections. The compound or radial adjustments which may be made with the form of tool supporting mechanism shown in Fig. 1, enables the operator to completely grind and finish all of the cylinders in a cylinder block with one setting or adjustment of the base 15 upon the block; and that, together with the additional adjustment features which will be described later enables the operator to quickly and easily grind all of the cylinders in a single block accurately and to substantially the same identical finish.

As will be seen from the foregoing, adjustment of the center stem 39 radially adjusts the abrading stones. To carry out the adjustment of these stones according to my invention, the enlarged head of the center stem 39 is provided with a cylindrical socket having slotted side walls adapted to receive the parti-spherical head of a universal connector stem 53, such head having a diametrically projecting pin 54 which engages the slots in the wall of the screw head. The other end of the universal connector 53 is also provided with a similar parti-spherical head having a diametrically projecting pin 55 arranged at right angles to the pin 54 at the other end, such pin 55 similarly engaging slots in the lower socketed end of a guide-connector 56 mounted in a cy-

lindrical bore in the lower shaft head 47. In the foregoing manner, universal connection is established between the screw stem 39 and the connector 56, and these parts are, also fixed together for simultaneous rotational movements. The connector 56 is cylindrical and fits rather snugly within the bore of the shaft head so as to provide true guidance and support for the adjustment-connections, the others of which will now be described. The upper part of the guide-connector is provided with a slotted-wall socket adapted to receive the lower parti-spherical end of a connecting rod 57, such lower end having a diametrically projecting pin 58 which enters the slots in the wall of its socket so as to provide an obvious universal action as well as fixing the parts together for rotation as a unit. The opposite end of the rod 57 is similarly shaped and engages a socket in the lower end of a rotatable gear-supporting part 58a. This end of the rod is also provided with a diametrically projecting pin 59 extending at right angles to the pin at the opposite end of the rod and which engages suitably located slots in the wall of its particular socket. Thus, universal-rotary connection is provided for as between the part 58a and the guide connector 56 and between these parts and the screw stem 39.

The gear-supporting part is provided with a reduced stem 60 which is rotatably mounted in an eccentric bore 61 in the lower part of the upper drive head 28 and it is fixed therein by the cross pin 52 engaging a circumferential groove 62 therein as clearly illustrated in Figs. 3 and 9. This reduced shaft part 60 projects beneath the shaft head 28 within the drive shaft 46 and fixedly carries an eccentrically disposed gear 63 which is of such diameter as to project slightly through an adjacent slot 64 (see Figs. 3 and 10) in the wall of the shaft 46. Rotation of the gear 63, obviously, will cause rotation of the rod 57, connectors 56 and 53 and the screw stem 39 to adjust the abrading stones.

Rotation of the gear 63 is provided for as follows: A sleeve device 65 having a knurled hand-grip surface 66 is rotatably mounted upon the shaft 46 and is held in place thereon by lower and upper rings or collars 67 and 68, in a manner well understood from Fig. 3. The upper internal wall portion of this sleeve 65 is provided with a plurality of teeth 69 which lie in the path of and mesh with the teeth of the gear 63 whereby rotation of the sleeve 65 will cause rotation of the gear and the screw stem 39. The lower sleeve-positioning collar 67 is held in place by seating against a shoulder 67' on the shaft 46 and the upper collar 68 is fixed in place by the cross pin 52 which holds the head 28, gear shaft 60 and drive shaft 46 together as a unit. The sleeve 65 is held snugly between these collars (but normal rotation is not interfered with) and when the shaft head 28 and shaft 46 are rotated with the tool in engagement with the cylinder wall surface, the torsional stress upon the shaft 46 due to the resistance to rotation of these parts offered by engagement with the cylinder wall surface (causing a slight torsional movement or twist of the shaft will normally tend to twist the collars in such a manner as to clamp the sleeve 65 more tightly between them, thereby normally holding the parts in position and preventing the mechanism, including the internal parts, from getting out of adjustment during operation once the operator has made an adjustment. This twisting action of the drive parts in binding or clamping the sleeve and collars together transform the drive parts into a rigid unit rendering the upper part of the shaft quite rigid and capable of withstanding the greatest strains and stresses without distortion or breakage.

Even though it may be desirable to lock the adjusting parts in their adjusted position normally, as above described, it is, at times, desirable from speed-operation and cost standpoints to adjust the tool while the driving parts are moving and without stopping the grinding operation. To that end, I employ a manually adjustable friction clutch device (Fig. 12) which is associated with the adjusting sleeve 65. This clutch takes the form of a yoked supporting part 69 hingedly carrying a pair of half-ring parts 70 each having a handle part 71 thereon. Each ring part on its inner wall supports friction material 72 of any suitable form and the handles 71 are normally spring-separated by a spring 73 mounted therebetween upon the bolt 74 as will be best seen in Fig. 12. The upper portion of the adjusting sleeve 65 is provided with a pair of circumferential, horizontally extending flanges 75, 75' defining therebetween a friction surface 76. The clutch device of Fig. 12 is adapted to be mounted upon the sleeve 65 with its friction surfaces 72 in position to engage the sleeve friction surface 76 (Fig. 1). The yoked part 69 of this clutch device projects out far enough to embrace the downwardly projecting shaft 77 which supports the clutch device against rotation when the clutch surfaces 70 and 76 are brought together with the tool in motion. When it is desired to make an adjustment without stopping the grinding operation, the operator merely grasps the handles 71 bringing the friction surfaces 72 and 76 together, thereby stopping or retarding rotation of the sleeve 65 which otherwise rotates with the drive shaft 46 as above described. As the stopping of retardation of the sleeve takes place with the shaft 46 continuing to rotate, relative rotational movement as between the sleeve and shaft 46 takes place, and, obviously, the gear 63 will be rotated to rotate the screw stem 39 to spread the stone carriers apart. This will be obvious from observing that the drive shaft 46 rotates in a clockwise direction while the sleeve is rotated in an anti-clockwise direction to spread the grinding stones apart. When the grinding stones have been adjusted with this clutch or brake device, the handles are released with consequent release of the friction surfaces by the handle-spreading action of the spring 73.

My invention further insures greater accuracy in the grinding of the single cylinder, as well as successive cylinders in the same or different cylinder blocks, by providing means for definitely fixing the grinding limits so that they will not be exceeded by either hand adjustment or by adjustment while the tool is in motion. Specifically, the upper portion of the sleeve-securing collar 68 is provided around its outer surface with a plurality of small teeth 78 (Figs. 3, 8 and 9) which are adapted to cooperate with teeth 79 on the upper inner surface of what may be termed a stop ring 80. The ring 80 is mounted around the collar 68 for both rotary and sliding movements relative thereto. When this ring is moved to its lowermost position (Fig. 3), the teeth 79 engage the teeth 78 of the collar 68 and hold the ring against rotation, but when this ring is moved upwardly to the dotted line position indicated in Fig. 2 against the shoulder 80' of the upper shaft drive head, the teeth 78 and 79 are

disengaged and the ring is free for relative rotation. The ring is provided with a recess 81 opening to its inner face adapted to receive a spring-pressed ball 82 which, when the ring is elevated as above described, engages the notches between the teeth 78 of the collar and normally hold the ring against rotation, but the ball yields under pressure to permit rotation of the ring. The upper part of the ring 80 (Fig. 7) is provided with a scale 83, each space on which may indicate .001 inch. I do not wish to be limited to this particular dimension as any desired dimension may be used. The upper edge of the adjusting sleeve 65 is provided with a pin 84 and the lower edge of the stop ring is provided with a pin 85.

When the tool is inserted in the cylinder, the ring 80 is moved to its dotted line position of Fig. 2 and the sleeve 65 is rotated to the right to adjust the abrading stones against the cylinder wall surface. When this has been done, the ring 80 is moved around until the pins 84 and 85 assume the relative positions indicated in dotted lines in Fig. 7. At this time, the zero mark 86 (Fig. 9) on the top edge of the adjusting sleeve 65 will register with the zero mark 87 on the ring scale 83. If it is desired to remove say .005 inch (or any other amount) from the cylinder wall surface, the ring 80 is rotated five (5) points to the right (looking at Fig. 3), so that its pin 85 is carried five (5) points away from the pin 84 on the sleeve 65, whereupon the ring is moved downwardly to engage its teeth with the teeth 78 and to fix it in that position to prevent further relative rotational movement as between the ring 80 and the collar 68. With the ring locked in this position, the adjusting sleeve 65 can be rotated to the right only until its pin again engages the pin 84 or a five-points movement which corresponds to an adjustment of the grinding stones to remove .005 inch from the cylinder wall surface. It will be noted that the upper part of the shoulder 80' on the upper drive shaft head is provided with a zero (or other) mark 88 (Fig. 2). This mark coincides with the teeth 78 and 79 and with the points on the scale 83 so that the operator can readily observe, from above, the number of points that the ring is moved in making any adjustment. The operator may also readily determine the number of points the ring has been moved by the "feel" of the ring when it is rotated and as the spring-pressed ball 82 snaps from notch to notch between teeth 78 on the collar 68.

The form of drive and adjusting mechanism shown in Fig. 13 is the same as that shown in the previous figures except as to the form of the rod 89 which connects the gear 64^a to the guide-connec or 56^a in the drive head on the lower end of the drive shaft. This rod is provided at its ends with flexible joints 90, 90' fixed to the ends of the rod 89 and the lower part of the gear hub 58^a and the upper part of the guide-connector 56^a, instead of the universal connections of the form of Figs. 1 to 12. These flexible parts may be formed in any desired manner so as to give the desired flexing action as between the respectively-attached parts. Otherwise, the construction and operation of this form of my invention is the same as that of the previous form.

In Fig. 14, I have shown still another form wherein an adjusting-connector rod 91 having a plurality of adjustable joints 92 at each end is substituted for the rods 57 and 89 of the previous forms. Specifically, these joints 92 are formed by providing in each part a groove 93 and a tongue 94, the tongue and groove in each part being arranged substantially at right angles to each other, so that, when these parts are connected together by the tongue-and-groove provision, a plurality of right-angularly-disposed joints are formed. The action of these joints at each end of the rod is substantially the same as the rods 57 and 89 (Figs. 3 and 13). Furthermore, in this form, I provide only for adjustment of the grinding stones when the grinding operation is stopped. In this instance, I provide the sleeve 95 having an outer knurled surface held between the fixed collars 96 and 97. The inner surface of the sleeve is provided with teeth 98 adapted to mesh with the teeth of the gear 64^b, so that upon rotation of the sleeve (as in the form of Fig. 3) the rod 91 will be rotated to adjust the grinding stones. In this form also, I omit the stop ring structure for limiting the extent of adjusting movement of the sleeve. In this form, once the adjustment has been set, the structure of the internal parts is such that the twist of the drive shaft 46^b will lock the sleeve between the collars 96 and 97, so that the adjustment of the same will remain fixed until the machine is stopped and the adjustment is intentionally changed by the operator. Otherwise, this form of Fig. 14 is the same in construction and operation as that described in connection with the previous figures.

It is to be understood that the several rods 57, 89, and 91 may be readily substituted one for the other with substantially the same good results. In each instance, the flexible connections between these rods and the connected parts permit of ease in rotation of the adjusting parts, regardless of their disalignment and regardless of the eccentric relation of the gears driven by the adjusting sleeve. With my invention, the adjustment may be readily carried out, also, regardless of the position of the driving shaft with respect to the tool; that is, the drive shaft may be tilted considerably with respect to the tool and the adjustment still may be freely made without injury to any of the parts.

It will be understood that while I have shown and described only three forms of my invention, other changes in details and arrangements of parts may be made therein without departing from the spirit and scope of my invention as defined by the claims which follow.

I claim:

1. In a cylinder grinding tool, the combination of a frame; a plurality of stone-carriers mounted for radial movement in said frame; a rotary drive element; a tubular element; universal joints between said tubular element and drive element and between said tubular element and said frame whereby said named elements and frame are connected for rotary movement; and means for adjusting said stone-carriers radially comprising wedge-means engaging wedge-surfaces of said carriers, a screw member carried within said frame and engaging said wedge-means for moving the same to spread said carriers, an adjusting sleeve mounted on said tubular element, and connections between said sleeve and said screw within said tubular element including a gear, rigid connector elements, and joints between certain of the connector elements permitting angular relationship therebetween without interfering with free rotary movement thereof.

2. In a cylinder grinding tool, a frame; stone-carriers carried by said frame; a tubular driving shaft connected to said frame; and means for adjusting said stone-carrier along said frame to-

ward and from the cylinder wall including devices engaging said carriers for outward movement thereof, a sleeve rotatably mounted upon said shaft and having teeth on its inner surface, a gear eccentrically mounted within said shaft and having its toothed surface projecting through a slot in the adjacent surface of said shaft and engaging the teeth of said sleeve, and connections extending through said shaft and associated with both said gear and said devices whereby movement of said sleeve is imparted to said devices for outward and inward movement of said carriers.

3. In a cylinder grinding tool, a frame; stone-carriers carried by said frame; a tubular driving shaft connected to said frame; and having a slot at one side at the end opposite said frame; and means for adjusting said stone-carrier along said frame toward and from the cylinder wall including devices engaging said carriers for outward movement thereof, one of said devices being a rotatable screw, a sleeve rotatably mounted upon the outer part of said shaft adjacent said slot and having teeth on its inner surface, a gear eccentrically mounted within said shaft and having its toothed surface projecting through said slot engaging the teeth of said sleeve, a coupling member within said shaft, a universal connection between said coupling member and said gear, another coupling member within said frame, a universal connection between said two couplings, and a universal connection between said latter-mentioned coupling and one of said carrier-engaging devices whereby movement of said sleeve is imparted freely to said carrier-engaging devices irrespective of angular displacement between said shaft and frame and the eccentric relation of said gear.

4. In a cylinder grinding tool, the combination of a unit adapted to be rotated within the cylinder which includes stone-carriers adjustable toward and from the cylinder wall, a rotatable driving element, a tubular member between and connecting said unit and driving element for imparting rotary motion to said unit, said member having a slot at one side, and means for adjusting said stone-carriers including a gear eccentrically mounted in said member with its toothed periphery projectng through said slot, connections between said stone-carriers and said gear, a pair of collars fixed upon said member on the opposite sides of said slot, and a rotatable sleeve mounted snugly between said collars and having teeth on its internal surface engaged with the teeth on said gear which project through said slot.

5. In a cylinder grinding tool, the combination of a unit adapted to be rotated within the cylinder which includes stone-carriers adjustable toward and from the cylinder wall, a rotatable driving element, a tubular member between and connecting said unit and driving element for imparting rotary motion to said unit, said member having a slot at one sde, and means for adjusting said stone-carrier including a gear eccentrically mounted in said member with its toothed periphery projecting through said slot, connections between said sone-carriers and said gear, and a rotatable device mounted upon said tubular member and having teeth on its inner surface which engage the teeth of said gear projecting through said slot.

6. In a cylinder grinding tool, the combination of a unit adapted to be rotated within the cylinder which includes stone-carriers adjustable toward and from the cylinder wall, a rotatable driving element, a tubular member between and connecting said unit and driving element for imparting rotary motion to said unit, said member having a slot at one side, and means for adjusting said stone-carriers including a gear eccentrically mounted in said member with its toothed periphery projecting through said slot, connections between said stone carriers and said gear, a rotatable device mounted upon said tubular member and having teeth on its inner surface which engage the teeth of said gear projecting through said slot, and means for locking said device against accidental rotation relative to said tubular member during rotation of the latter and for releasing said device for relative rotation when said tubular member is at rest.

7. In a cylinder grinding tool, means insertable within the cylinder bore for grinding the wall surface thereof, means for rotating said grinding means during the grinding operation, and means for adjusting said grinding means including a device accessible when said foregoing means are assembled for the grinding operation and other devices inaccessible during such latter condition and connecting said accessible device with said grinding means, and clamping elements rendered effective by torsional stresses set up in said rotating means due to resistance to rotation of the grinding means offset by its engagement with the cylinder bore surface for holding said accessible device against abnormal adjusting movements when said rotating means is actuated, said elements being ineffective for such holding when said rotating means is at rest.

8. In a cylinder grinding tool, the combination of a frame adapted to carry grinding stones, means for imparting rotary motion to said frame, including a shaft having a tubular part with a slot therein, and means for adjusting said stones toward and from the cylinder wall surface including a gear having its teeth projecting through said slot, a rotatable sleeve on said shaft and having teeth on its inner surface engaging the teeth of said gear, and collar-like clamp elements fixed upon said shaft on the opposite sides of said sleeve and snugly engaging the same, said elements being adapted to bind against said sleeve as torsional strain is imposed upon said shaft by rotation thereof with the grinding stones engaged with the cylinder wall surface and thereby render said elements and sleeves a substantially solid reinforcing unit upon said shaft and to also normally prevent relative rotation of said sleeve as said shaft is operated.

9. In a cylinder grinding tool, the combination of a frame having a connection-sleeve; stone-carriers mounted in said frame; wedge-means within said frame engaging said stone-carriers; a screw-stem engaging said wedge-means and having an enlarged universal-socket-head projecting into said frame sleeve; a drive element; a tubular shaft having universal connection with said frame sleeve and said drive element, such shaft having a slot at one side in its end adjacent said drive element; and means for moving said screw-stem for adjustment of said stone-carriers comprising a gear eccentrically mounted in said shaft with its toothed periphery movable through said slot, a universal-socket-hub dependingly carried by said gear, a connecting rod within said shaft and having spherically-headed ends one of which is mounted in said gear hub socket, a block concentrically and rotatably mounted in the end of said shaft adjacent said frame, said block having universal joint sockets in its opposite ends, one of said block sockets receiving the other

spherically-headed end of said connecting rod, another connecting rod within said frame sleeve and having spherically-headed ends one of which engages the other socket of said block and the opposite end of which engages the socket in the enlarged head of said screw-stem, all of said spherically-headed ends having means engaging said respective sockets to prevent relative rotation, and a device mounted upon the outer part of said shaft having teeth engageable with the teeth of said gear projecting through said shaft slot for imparting adjusting movements to said screw-stem through said connecting rods.

10. In a tool of the class described, a frame, expansible and contractible wall-engaging elements supported by said frame, a tubular driven member, universal joint means connecting said driven member to said frame, means engaging said elements for expansion and contraction of the latter, an exteriorly accessible member carried by said driven member and rotatable with and relative to said driven member, and connecting means between said expanding and contracting means and said exterior member for actuating said expanding and contracting means which includes a rotatable guide member mounted in said driven member, a shaft having universal connection with both said exterior member and said guide member, and another shaft having universal connection with both said guide member and said expanding and contracting means.

11. In a cylinder grinding tool, abrading means, rotary drive means for said abrading means, means for adjusting said abrading means including an adjusting member mounted on said drive means for rotation therewith and also relative thereto, and means for limiting adjustment of said abrading means to a selected extent which includes a stop member mounted on said drive means for axial shift movement, said stop member being adapted to be fixed against rotation upon said drive means in one axial position of said stop member and adapted for rotative adjustment relative to said drive means in another axial position, spring means yieldably resisting rotation of said stop member in its rotative position, and stop abutments on said stop member and adjusting member engageable with each other in the non-rotative position of said stop member.

12. In a cylinder grinding tool, abrading means, rotary drive means for said abrading means, means for adjusting said abrading means including an adjusting member mounted on said drive means for rotation therewith and also relative thereto, means operable to engage said adjusting member during operation of the tool to effect relative rotation between said drive means and said adjusting member to adjust said abrading means, and means for limiting adjustment of said abrading means to a selected extent which includes a stop member mounted on said drive means for axial shift movement, said stop member being adapted to be fixed against rotation upon said drive means in one axial position of said stop member and adapted for rotative adjustment relative to said drive means in another axial position, spring means yieldably resisting rotation of said stop member in its rotative position, and stop abutments on said stop member and adjusting member engageable with each other in the non-rotative position of said stop member and adapted to prevent further adjustment of said adjusting member when said adjusting-member-operating means is engaged therewith.

13. In a cylinder grinding tool, abrasive means, means for driving said abrasive means in rotary direction, means for adjusting said abrasive means including an exteriorly accessible adjusting member mounted for rotation relative to said drive means, means for limiting the extent of rotation of said adjusting member relative to said drive means for limiting the adjustment of said abrasive means to a limited extent which includes a member fixedly mounted on said drive means and having teeth extending axially of said drive means, a ring member having internal teeth mounted on said drive member for axial slide movement, the teeth of said ring member in one axial position of the latter engaging the teeth of said fixed member to fix said ring member against rotation and said ring member in another axial position being adapted to rotate relative to said drive means, means carried by said ring member yieldably opposing rotary movement thereof relative to said drive means, and stop abutments on said adjusting member and said ring member engageable with each other to limit adjustment movement of said adjusting member in the said non-rotative position of said ring member.

14. In a cylinder grinding tool, means insertable within the cylinder for grinding the latter, means for rotating the grinding means, means for adjusting the grinding means to expand and contract the latter, and means operable under the control of said rotating means for preventing accidental adjusting movement of said adjusting means during rotation of said grinding means, said means permitting free adjustment of said adjusting means when the tool is at rest.

15. In a cylinder grinding tool, means including abrasive members insertable within the cylinder for grinding the latter, drive means for rotating the grinding means, a driven unit connecting said drive means and said grinding means, means on said driven unit for adjusting the abrasive members of said grinding means to expand and contract the latter, and means associated with said driven unit and adjusting means and operable under the control of said drive means for preventing accidental adjusting movement of said adjusting means during rotation of said grinding means, said means permitting free adjustment of said adjusting means when the tool is at rest.

16. In a cylinder grinding tool, the combination of a frame, a plurality of abrasive members mounted in said frame, a rotary drive element, a tubular element, joints affording universal action between said tubular element and drive element and between said tubular element and said frame whereby said named elements and frame are connected for rotary movement, and means for adjusting said abrasive members radially comprising wedge-means engaging wedge-surfaces on said abrasive members, a screw member carried within said frame and supporting said wedge means for moving the latter to spread said abrasive members, an adjusting sleeve mounted on said tubular element, and connections between said sleeve and said screw within said tubular element including a plurality of connector elements with joints therebetween adjacent said first-named joints permitting angular relationship between said connector elements to accommodate the angular movement afforded by said first-named joints associated with said tubular member.

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