Jan. 31, 1928. 1,657,713

G. A. GOULD

CYLINDER GRINDER

Filed Dec. 18, 1922 3 Sheets-Sheet 1

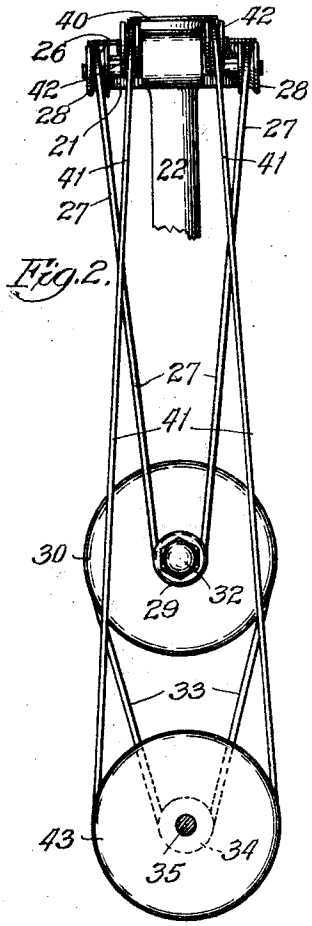


Fig. 2.

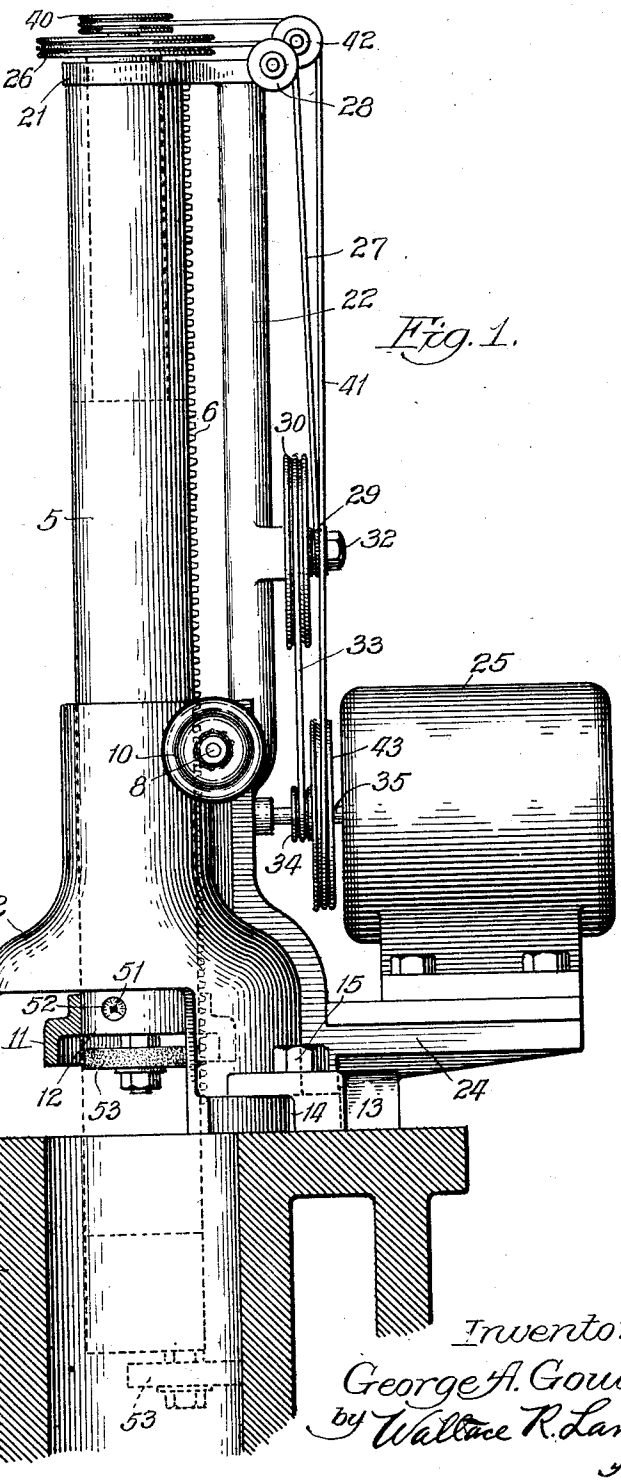


Fig. 1.

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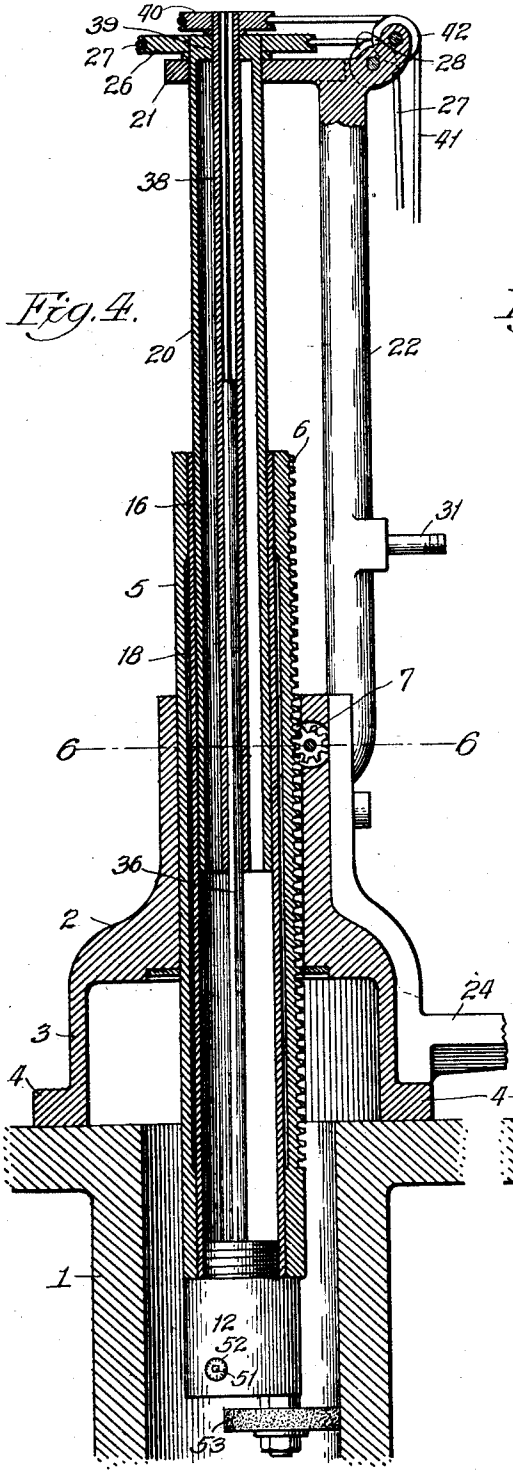


Fig. 4.

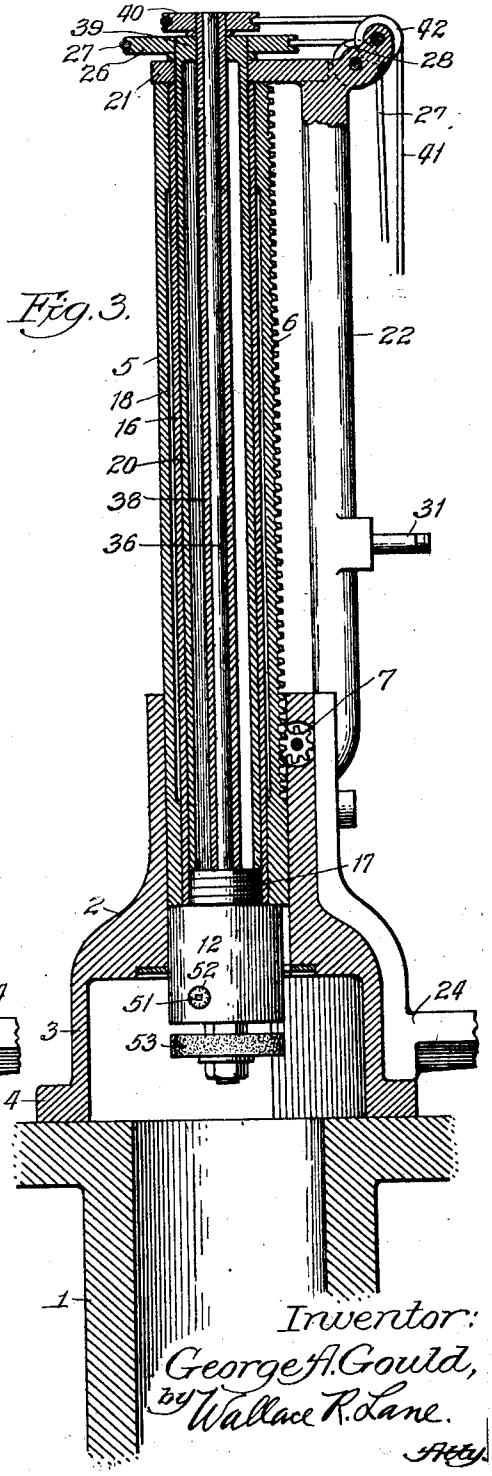


Fig. 3.

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Fig. 5.

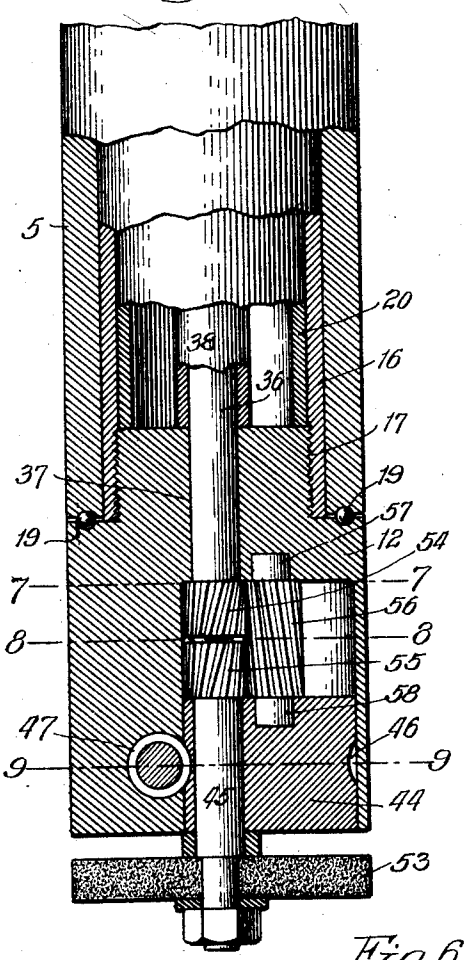


Fig. 7.

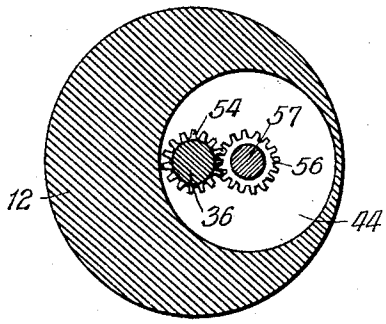


Fig. 8.

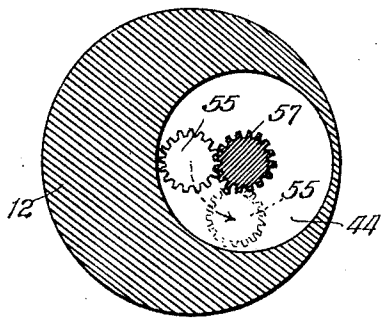


Fig. 6.

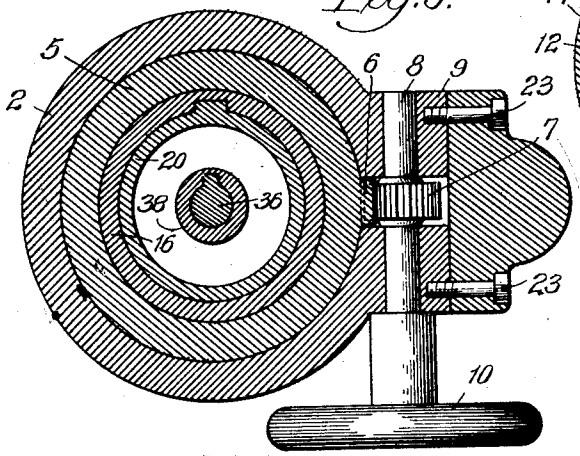
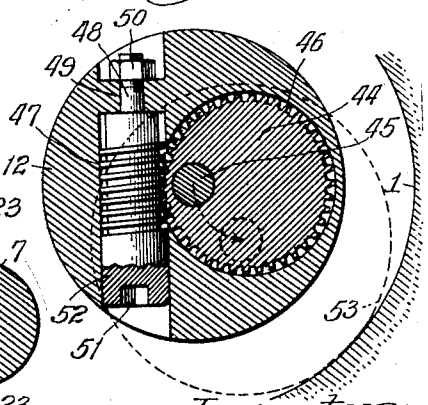


Fig. 9.



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Patented Jan. 31, 1928. 1,657,713

UNITED STATES PATENT OFFICE.

GEORGE A. GOULD, OF SCHENECTADY, NEW YORK.

CYLINDER GRINDER.

Application filed December 18, 1922. Serial No. 607,515.

The present invention relates to machines or mechanism for grinding or finishing the surfaces of cylinders, particularly the cylinders in internal combustion engines, used in automobiles, tractors, power boats and other like and similar apparatus.

Among the objects of the invention is to provide a grinding mechanism of light weight, small volume, and being easily carried about and attached to the cylinder block of the engine for grinding out the cylinder, or otherwise operating thereon; to make the same with the operating parts in a slidable column and movable with the column, whereby increased rigidity may be obtained as the grinding member is caused to enter more or less into the cylinder; to provide a standard with operating parts at its upper end which do not move with the operating parts connected to the column; to provide means, such as centering rings, aligning the grinding mechanism or centering it with respect to the axis of the cylinder to be ground when setting up the apparatus; to provide for driving means, such as spiral gears, for driving the grinding spindle from the driving shaft, whereby a very smooth, and uniform grinding operation may be obtained without chattering or vibration; to construct a gear head, with eccentric spindle bearing means, which may permit the adjustment of the grinder to make a more or less deep, or slight cut, in the cylinder wall, as desired, together with suitable means for adjusting the same at will; to provide a support for the column in the operating mechanism which may be rigidly secured to the cylinder block in adjusted position, and which will also permit ready access to the interior of the support and the cylinder, as well as permit a visibility of the operation, undergoing way; to make the operating mechanism of extensible sections, of which one set is rotatably mounted in the stationery upper end of a standard rigidly fastened to the support and the other set is movable with the column to a greater or less depth in the cylinder; to provide for the use of a number of centering rings, each of which have an outside diameter to fit the particular cylinder to be ground, and having an internal diameter to fit a part of the operating mechanism; to provide for mounting the grinder spindle in a bearing that is rotatably mounted in the head of the mechanism eccentrically with respect to the axis of the column, and connecting the spindle with the driving shaft by gears, preferably spiral gears, including an elongated spiral gear acting as an idler whose axis is coincident with the axis of the rotatable bearings, so that the gear on the spindle may be made to move about the axis of the idler without disengaging from the idler gear; and such further objects, advantages, and capabilities as will later more fully appear, and are inherently possessed by the invention.

In the drawing illustrating the preferred form of the invention, Fig. 1 is a view in side elevation of an assembled grinding mechanism connected to the cylinder to be ground, the cylinder being shown in vertical section; Fig. 2 is a fragmentary view in elevation of the drive between the motor and the upper part of the mechanism; Fig. 3 is a vertical sectional view taken through the apparatus and a cylinder to be ground; Fig. 4 is a like view showing the mechanism in operation with the grinder extending into the cylinder; Fig. 5 is an enlarged detail sectional view of the lower end of the grinding mechanism, showing in detail the driving gears between the driving shaft and the grinder spindle; Fig. 6 is a horizontal sectional view taken on line 6—6 of Fig. 4 of the drawing; and, Figs. 7, 8, and 9, are, respectively, horizontal views taken on lines 7—7, 8—8 and 9—9 of Fig. 5 of the drawing.

Referring more in detail to the drawing, the invention is shown in connection with a cylinder 1, the interior surface of which is to be ground. After the cylinder cap is removed, the apparatus, which is readily portable, may be located upon the cylinder block by locating the same over the opening of the cylinder. The mechanism comprises, generally, a support or supporting member 2, having two or more legs 3 provided at their lower ends with feet or flanges 4. In the supporting member 2 is vertically, slidably, supported or mounted, a cylindrical column 5 having on its outer surface a rack 6 with which engages a pinion 7 fast with a spindle 8 rotatably mounted in a boss 9 integral with the support 2,—see Fig. 6 of the drawing. To an end of the spindle 8 is fastened a hand wheel 10 by which the pinion 7 may be rotated to cause the column 5 to be lowered or raised as required.

For the purpose of centering the mechanism so that it will be co-axial with the axis of the cylinder to be ground, a centering

ring 11 is used. There are a series of rings for fitting different size cylinders and among such rings may be selected the one fitting the particular size cylinder to be ground, and the same is connected to a head 12 of the grinding mechanism. With the ring 11 in place, as shown in Fig. 1 of the drawing, the hand wheel 11 is operated to lower the column 5 and the mechanism carried thereby, until the ring 11 enters into the cylinder 1, thus determining the proper location or relation of the support 2. With the latter properly centered, the same is clamped or rigidly secured in place by means of dogs 13, extending over the flange 4 of each leg 3 of the support, and apertured to receive the stud bolt 14, forming a fixed part of the cylinder block, the nuts 15 being turned or tightened in place to securely hold the dogs against the flanges 4. When the support 2 has thus been centered the operating handle 10 may again be operated to raise the column, and owing to the space provided between the legs of the support, the ring 11 may now be removed from the head 12, when the grinding mechanism will be ready for operation.

Within the cylinder 1 is rotatably mounted or supported a feed member 16, preferably of cylindrical form, and having secured at its lower end, preferably by a thread 17, the head 12. It will therefore be noted that the member 5 and the head 12 act together as a unit, both for rotary and vertical movements. An elongated clearance space 18 may be provided between the inner portion of the column 5 and the outer surface of the member 16, for facilitating the rotating of the member 16 in the column 5, as well as providing for a space for a lubricant. Furthermore, for the purpose of reducing the friction between these members, ball bearings 19 may be provided between the lower end of the column 5 and the upper portion of the head 12, as clearly shown in Fig. 5 of the drawing. To the member 16 is suitably splined a telescopic member 20, with its upper end rotatably supported or mounted in the shelf portion 21 of a standard 22 rigidly connected, as by means of screws 23, at its lower end, to the supporting member 2, as clearly shown in Figs. 3, 4 and 6 of the drawing. The lower extreme end of the standard 22 is preferably provided with a laterally extending table 24, upon which may be supported a driving motor 25, suitably connected with driving elements, as will more fully hereinafter appear. It will thus be seen that the members 16 and 20 form together a telescopic unit of two sections, splined together so that they may rotate in unison, but that the member 16 is capable of sliding vertically with respect to the member 20 when the column 5 is adjusted to project the grinder more or less within the cylinder to be ground. Fig. 3 of the drawing shows the parts when they are in full nested position, and Fig. 4 of the drawing shows the same parts in partly extended position. To the upper end of the member 20 is suitably secured or fastened a large diameter pulley 26, over which operates a belt 27 passing over idler pulleys 28, rotatably supported in the upper end portion of the standard 22. The belt 27 passes downwardly over a small pulley 29 rigid with a larger pulley 30, both rotatably mounted upon a stud 31 forming a rigid part of the standard 22, a thrust nut 32 threaded on the end of the stud 31, serving to hold the pulleys 29 and 30 in position on the stud. From the pulley 30 passes a belt 33, over a small pulley 34 fastened to the shaft 35 of the motor 25. It will thus be apparent that the members 20, 16, and the head 12 will be rotated at a relatively slow speed by the motor 25. The purpose of this drive is to carry the grinder around the cylinder, as the same is caused to operate upon the inner surface of the cylinder. It will appear more clearly hereinafter.

Within the members 20 and 16 is rotatively included a sectional shaft having a lower solid section 36, rotatively supported at its lower end in a bearing 37, provided in the upper end of the head 12, as clearly shown in Fig. 5, of the drawing. The upper end portion of the shaft 16 slides in a tubular section 38 having its upper end rotatively received in a bearing 39 formed in the upper end of the member 20. Both shaft sections 36 and 38 are splined to permit longitudinal relative movement of the sections, but to make them rotate in unison. It will thus be apparent that the section 36 is vertically slidable with the members 16 and 5 when the grinder is lowered or raised in the cylinder. The section 38 will remain in its stationary position, with the exception of its rotating in the bearing 39, as will appear more clearly hereinafter. At the upper end of the member 38 is fastened or secured in any suitable manner, a relatively small pulley 40, over which passes a belt 41 passing over idlers 42, rotatively supported in the upper portion of the standard 22. The belt 41 passes downwardly to a large pulley 43, fixed to the armature shaft 35, of the motor 25. In this way it will be noted that by using a large pulley 43 and a small pulley 40, the motor is capable of driving the central shaft 36—38 of the grinding mechanism at high speed, the purpose being for driving the rotary cutter or abrasive member in the cylinder at grinding velocity, as the same is caused to be fed over the surface of the cylinder when the members 16, 20 and 12 are rotated together.

Referring more particularly to Figs. 5, 7, 8 and 9, the head 12 is of generally cylindri-

cal form, having its upper portion secured to the lower end of the member 16 as by threads 17. In the lower end portion of the head 12 is rotatably mounted a cylindrical bearing member 44, having its axis to one side of the axis of the head 12, or shaft section 36, or, in other words, being located eccentrically with respect to the axis of the shaft 38 of the grinding mechanism as a whole. In the bearing member 44 is rotatably supported a grinder spindle 45, having its axis eccentric to the axis of the bearing member 44, and at a distance from the axis of the member 44, such that the axis of the spindle 45 may be co-axial with the axis of the shaft section 36, in one position of the spindle 45 and bearing member 44, as shown in Fig. 5 of the drawing. The periphery of the member 44 is provided with worm gear teeth 46, with which engages a worm screw 47, rotatably supported, in a suitable manner, in a socket provided transversely in the head 12. This is clearly shown in Fig. 9 of the drawing. One end of the worm 47 has a thrust shank 48, extending through a bearing portion 49 of the head 12, and has connected at the end of the shank a nut 50, as shown in Fig. 9 of the drawing. The other end of the worm screw has a polygonal socket, preferably square, to receive a socket wrench, whereby the worm screw may be rotated as desired. It will be noted that the end portion 52 of the worm screw is wholly enclosed within the transverse socket of the head 12 so that it will not protrude beyond the outer surface of the head 12. It will be apparent that, as the worm screw 47 is rotated in one direction or the other, the bearing member 44 will be caused to rotate about its central vertical axis, as clearly shown in Figs. 5 and 9 of the drawing. At the lower end of the spindle 45 is suitably secured a grinding or abrasive member 53, preferably of disc form, the periphery of which may be brought into contact with the interior surface of the cylinder 1, for the purpose of removing material or polishing it, depending upon the work to be performed.

At the lower end of the shaft section 36 and the upper end of the spindle 45 are respectively secured, or otherwise suitably fastened, spiral pinions 54 and 55, but it will be noted that these pinions are not in mesh with each other, but are located, one beneath the other, that is, the pinion 55 is below the pinion 54 and spaced slightly therefrom. It will also be noted that when the member 44 is rotated in one position, the pinion 55 is directly below the pinion 54. At on side of these pinions is rotatably supported an idler spiral pinion 56 which is preferably elongated and is also in mesh with both pinions 54 and 56, as clearly shown in Figs. 5, 7 and 8 of the drawing. The pinion 56 has trunnions 57 and 58 at the ends thereof and is rotatably supported in bearing sockets provided in the upper part of the head 12, and in the bearing member 44. The axis of the pinion 56 is coaxial with the central axis of the bearing member 44. From this construction it will be observed that the pinion 54 drives the pinion 56, which in turn will drive the pinion 55, and by reason of the latter being fixed to the spindle 45, it will drive the spindle and the grinding wheel 53.

Moreover, by reason of this particular construction, it will also be apparent, that the bearing member 44 may be rotated, as desired, carrying with it the spindle 45 and the gear or pinion 55. Assuming, in the first place, that the spindle 45 is co-axial with the shaft section 36, which is the innermost position of the spindle 45 and grinding wheel 53, the spiral pinion 55 will be located directly beneath the pinion 54, as shown in Fig. 7 of the drawing. After the column has been moved downwardly so as to carry the head 12 and the grinding wheel 53 into the cylinder 1, the bearing member 44 may be rotated so as to carry the spindle 45, gear 55 and the grinding wheel 53 about the central axis of the member 44, so as to cause the grinding wheel 53 to move away from the central axis of the grinding mechanism, that is, the axis of the head 12 and shaft section 36. This operation may be continued until the grinding wheel 53 contacts with the interior surface of the cylinder 1. After the grinding wheel has been fed outwardly to the proper cutting distance, the gear 55 will probably have the position shown in dotted lines in Fig. 8, the gear 55, and spindle 45 having been moved from the full line position of the gear 55 to the dotted line position of the same, as shown by the arrow in Fig. 8 of the drawing. The new position of the grinding wheel 53 will be shown in dotted line Fig. 9 of the drawing. It will be noted that during this movement, inasmuch as the pinion 55 moves in an arch path above the axis of the pinion 56, the gear 55 will remain constantly in mesh with the gear 56, although the same may be rotating about its own axis at the same time.

During the operation of the device, the motor drives the central shaft 36—38 at a high speed, and hence the rotating cutter 53 operates at a very high speed against the inner surface of the cylinder 1. At the same time the motor also drives the feed member 16—20 at slow speed, thus rotating the head 12, and inasmuch as the latter carries the bearing member 44 and the driving mechanism between the shaft section 36 and the spindle 45, the head 12 is rotated in a circle about the axis thereof or the axis of the shaft section 36, which is also the central axis of the grinding mechanism in general, and the rotating cutter 53 is carried around in

the cylinder in the path of a circle, while the cutter 53 is rotating about its own axis to perform the grinding operation upon the cylinder surface. In this way it will be observed that the members 16 and 20 driven at a slow rate, constitute a feeding mechanism for feeding the rotary cutter around the inside of the cylinder while the cutter is operating on the surface of the cylinder. In this way a perfectly circular or cylindrical inner surface of the cylinder will be obtained.

By making the rotating members of the mechanism within the column of telescopic sections, the upper sections thereof may be held in stationary position while the column for the other section may be lowered to a greater or less extent as required for the purpose of grinding the length of the cylinders. By moving the column as a whole, together with the other elements included therein, and by reason of the column having a large diameter, it enures to the rigidity of the apparatus so that a heavy cut may be taken with the cutter or grinding wheel 53 without flexing the supporting member thereof. Ordinarily, when the driving shaft carrying the grinding wheel is the only member that moves from its bearing support, a slight lateral pressure or resistance against the grinding wheel will cause the driving shaft to flex or bend, and consequently a correct and perfect grinding of the cylinder cannot be obtained. By having the rotating members fitting closely within the column, which is slidably adjustable in the supporting member, greater rigidity is obtained, and a greater depth of cut can be effected, to the end of reducing work or finishing a job in much shorter and more convenient time.

While I have herein described and shown upon the drawings a preferred embodiment of my invention, it is to be understood that the invention is not limited to the particular construction, arrangements and details of parts shown and described, but that other constructions, details and arrangements of parts are comprehended by the invention without departing from the spirit thereof.

Having now described my invention, I claim:—

1. In a machine for grinding cylinders, the combination of a support, a column adjustably mounted in the support, a carrier member rotatably mounted in the column, and movable therewith when the column is adjusted, a head member secured to the lower end of the carrier member, a driving shaft rotatably and concentrically mounted in said head, a bearing member rotatably and eccentrically mounted in said head, a grinder spindle rotatably mounted in said bearing, means for rotating the bearing whereby the spindle is moved to and from the axis of the head for decreasing and increasing the cut of the grind in the cylinder wall, and means connecting the shaft and spindle whereby the latter is driven by the former, and means for operating the shaft and carrier member.

2. In a mechanism for grinding cylinders, the combination of a support, a standard rigid with the support and extending upwardly above the support, a column mounted in the support, means for slidably adjusting the column in the support, a pair of splined members rotatably mounted respectively in the column and the upper end of the standard whereby the member in the column moves when the column is adjusted, a grinder carrying head fastened to the lower end of the member in the column, a pair of splined shaft sections rotatably mounted in said head and the upper end of said standard, means in said head for driving the grinder from the shaft in any position of the grinder and means at the upper end of the standard for operating the splined members and shaft sections.

In witness whereof, I hereunto subscribe my name to this specification.

GEORGE A. GOULD.