Nov. 1, 1927. 1,647,129

L. R. HEIM

GRINDING

Filed Oct. 17, 1921

Fig. 1.

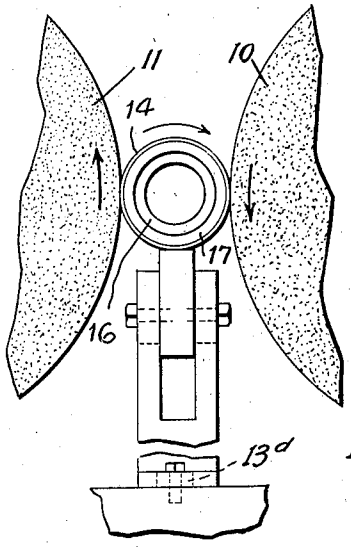


Fig. 2.

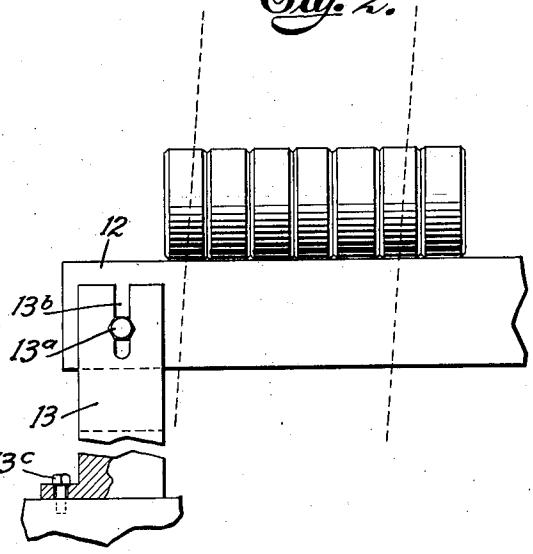


Fig. 3.

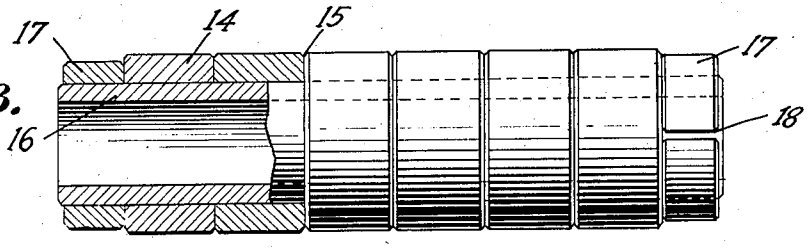
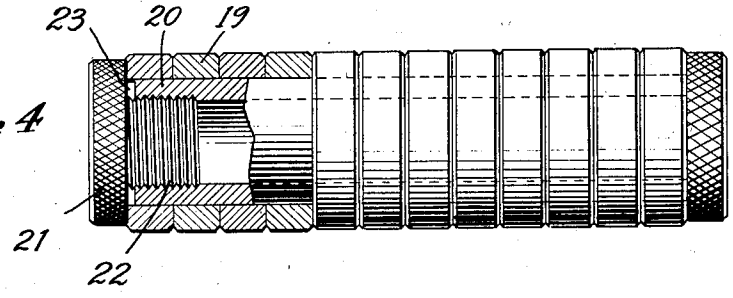


Fig. 4



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UNITED STATES PATENT OFFICE.

LEWIS R. HEIM, OF DANBURY, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CINCINNATI GRINDERS INCORPORATED, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

GRINDING.

Application filed October 17, 1921. Serial No. 508,126.

This invention relates to grinding, and with regard to certain more specific features thereof, to the centerless grinding of cylindrical articles. One of the objects thereof is to provide a simple art by which articles may be rapidly and accurately ground even though of an unfavorable shape of size. Another object is to provide grinding apparatus of a simple and practical nature adapted for rapid and efficient and exact action. Another object is to provide simple and inexpensive means for supporting during grinding an article of a shape unfavorable to such action. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangement of parts and in the several steps and relation and order of each of the same to one or more of the others thereof, all as will be illustratively herein described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is shown one or more of various possible embodiments of the mechanical features of this invention,

Figure 1 is an end view;

Figure 2 is a side elevation, certain parts being diagrammatically illustrated in order to show the construction more clearly;

Figure 3 is an enlarged side elevation of work-supporting means shown partially in central vertical section; and

Figure 4 is a similar view showing another embodiment of certain of the mechanical features of this invention.

Similar reference characters refer to similar parts throughout the several views of the drawing.

As conducive to a clearer understanding of certain features of this invention, it may here be noted that in the grinding of cylindrical bodies of certain shapes, such as those having a large diameter relative to their axial length, there is a tendency of the bodies to work out of position by a swinging movement of their planes, thus resulting in inaccurate grinding and possible wedging against the wheels. In order that the articles ground may be free from taper, of uniform diameter, and precisely round, it is of course necessary that their position relative to the operative grinding element be accurately predetermined. The achievement of this end without sacrifice of speed of action or material complication of the parts, is amoung the dominant aims of this invention.

Referring to Figure 1 of the drawing, there is shown a downwardly and rapidly rotating grinding wheel 10 and an upwardly and slowly rotating regulating wheel 11, the rate of rotation of the former preferably being many times that of the latter. The opposite direction of movement of the operative surfaces of these wheels where they contact the work is indicated by the arrows in the drawing. These wheels co-act in operating on the work substantially in accordance with the principles of my invention set forth in my patent, Reissue No. 15,035.

Positioned beneath the work and supporting the same is a work support 12 mounted on the supporting post 13, the illustration of these parts being diagrammatic and it being understood that the member 12 is adjustable with relation to the wheels vertically, laterally and angularly by any such means as those shown for example in my above reissue patent. These adjustments are diagrammatically indicated by the bolt 13^a passing through the open-ended slots 13^b at the upper end of the support 13 thus affording angular and vertical adjustment of the work support by a set screw 13^c passing through a slot 13^d and into the frame of the machine, giving adjustment of the work support toward and away from the wheels. It will also be understood that the rotation and feed of the work is goverened by the regulating wheel 11 which is set so that the path of travel of the operative face thereof, where it contacts the work, is inclined at a slight angle with respect to the path of travel of the work, as diagrammatically indicated in Figure 2 of the drawing, all as more fully explained in my above mentioned patent.

Considering now the mounting of the work, the articles to be ground are illustrated at 14 in Figure 3 of the drawing and comprise a number of rings, the outer extreme edges of which are slightly beveled as at 15. This work however is merely illustrative of the various articles which my invention is well adapted to handle. These articles are placed upon a hollow mandrel 16 provided at its ends with spring collars

17, split as at 18 and adapted to grip the mandrel with such force as to maintain their position thereon throughout the grinding operation. These collars are slipped over the ends of the mandrel with the rings assembled thereon, and automatically clamp them in position. It is to be noted however that in the preferred use of this invention the rings 14 are free for relative turning movement so that they may rotate independently if necessary during the grinding operation. If the regulating wheel 11, which governs the rotation, is of such shape to present an active surface which travels at different speeds at different portions thereof, these rings may accommodate themselves to such condition without substantial slip with respect to the regulating wheel.

It is also to be noted that a tight fit of the rings on the mandrel is unnecessary and when the inner surfaces of the rings are not accurately ground, such fit is undesirable. Furthermore it is to be understood that the end collars 17 are to be so adjusted lengthwise of the mandrel that they merely lock the rings against separation and yet do not cramp them or tend to tilt their axes with respect one to another. As above noted there is ordinarily an appreciable looseness of the rings on the mandrel so as to permit a slight relative movement of the rings in a radial direction during the grinding operation. Each ring is adapted to be rotated by the regulating wheel independently of and relative to the other rings and the mandrel, and is permitted the radial movement allowed by the difference between its inner diameter and the outer diameter of the mandrel.

With the device thus assembled, it is placed on the carrier 12 and its forward ring 14 fed between the grip of the wheels, suitable guiding means being provided as set forth in my above reissue patent. The collars 17 are preferably of slightly reduced diameter with respect to the work in order to avoid grinding of their surfaces and hence pass freely between the wheels. The rings, however, dependably held in substantially their proper relation with respect to the wheels, pass through the wheels and are rotated, advanced and accurately ground. It is to be understood that although during this action the rings 14 rotate relative one to another, nevertheless certain advantages in speed of grinding articles of this nature could be achieved with a construction in which they are rigidly clamped so that the entire device turns as a unit. When the device has passed through the wheels it is removed and one of the collars taken from the mandrel, whereupon all of the rings may be removed and another set of rings placed in position thereon and ground. It may be noted that one of the collars may if desired be formed as a shoulder on the mandrel although it is preferred to have each of these abutments adjustable lengthwise of the mandrel so that the device may be in balanced form as it is fed through the machine.

In the construction shown in Figure 4 of the drawing, the rings 19 are similarly mounted on the mandrel 20 but the end members take the form of screws having the knurled heads 21 so shaped that they act as stops for the rings. These screws are threaded in this illustration inside the mandrel, as indicated at 22, and both screws may be formed alike. Also at one or both ends there is preferably a clearance between the end of the mandrel and the head of the screw, as indicated at 23 in order to permit the rings to be engaged with the desired degree of firmness. In carrying on my process with this latter apparatus the method is substantially the same as when the device shown in Figure 3 is utilized.

The mandrels may be of any desired length or diameter, and the remainder of the machine is adjustable, as explained in my above mentioned reissue patent to accommodate such variations in size.

As various possible embodiments might be made of the mechanical features of this invention, and as the art herein described might be varied all without departing from the scope of my invention, it is to be understood that all matter herein described or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim as my invention:—

1. The herein described art of grinding which consists in positioning face to face a plurality of cylindrical articles of short axial length relative to their diameters, positively holding against tilting said articles thus positioned, rotating said articles independently of each other by applying a rotative force at one point of their circumference, grinding said articles during rotation at another point of their circumference, and feeding said articles axially as a unit past said rotating and grinding agencies.

2. The herein described art of grinding which consists in positioning face to face a plurality of cylindrical articles of short length relative to their diameters and hence having individually a tendency to tilt, positioning in engagement with said articles thus positioned, means which holds the articles against tilting but permits a slight relative radial movement thereof and permits independent relative rotation thereof, rotating said articles independently of each other as they are thus held by applying a rotative force at one point of their circumference, grinding said articles during rotation at another point of their circumference, and feeding said articles axially as a unit past said rotating and grinding agencies.

3. The herein described art of grinding which consists in placing a plurality of rings in a continuous row upon a mandrel, clamping said row of rings at the two ends thereof to prevent subsantial axial movement of said rings relative to said mandrel but to permit rotation of said rings relative to said mandrel and to each other, and feeding said rings and said mandrel axially as a unit between grinding and regulating wheels to grind the peripheries of said rings.

4. The herein described art of grinding which consists in placing a plurality of rings in a continuous row upon a mandrel having a diameter slightly less than the internal diameter of said rings, clamping said row of rings at the two ends thereof to prevent substantial axial movement of said rings relative to said mandrel but to permit rotation of said rings relative to said mandrel and to each other and to permit the relative radial movement of said rings allowed by said difference in diameters, and feeding said rings and said mandrel axially as a unit between grinding and regulating wheels to grind the peripheries of said rings.

5. The herein described art of grinding cylindrical work of short axial length relative to its diameter which consists in feeding the work axially into a passage therefor between a grinding wheel and a regulating wheel, the grinding wheel being adapted to engage and grind the periphery of the work and the regulating wheel being adapted to engage and rotate the work, the path of travel of the operative surface of said regulating wheel at its point of contact with the work being inclined with respect to the path of movement of the work whereby said regulating wheel exerts a force upon the work tending to fed it along said passage and tending to twist said short work out of its coaxial relation to said passage, positioning in engagement with the work as it is thus fed into said passage means to support the work against said twisting force effected by said regulating wheel and thereby holding the work in its proper coaxial relation to said passage.

6. The herein described art of grinding rings of short axial length relative to their diameters, which consists in feeding the rings axially into a passage therefor between a grinding wheel and a regulating wheel, the grinding wheel being adapted to engage and grind the periphery of the rings and the regulating wheel being adapted to engage and rotate the rings, the path of travel of the operative surface of said regulating wheel at its point of contact with said rings being inclined with respect to the path of movement of the rings whereby said regulating wheel exerts a force upon the rings tending to feed the rings along said passage and tending to twist them out of their coaxial relation to said passage, and engaging the rings internally as they are fed into said passage by means adapted to support the rings against said twisting force effected by said regulating wheel and thereby holding the rings in their proper coaxial relation to said passage.

7. The herein described art of grinding the peripheries of cylindrical articles of short length relative to their diameters and hence having a tendency to tilt, which consists in positioning a plurality of said articles face to face and in substantial axial alignment, positioning in engagement with the articles thus positioned means which holds the articles against tilting but permits relative radial movement thereof and permits relative rotation thereof, rotating said articles independently of each other as they are thus held by applying a rotative force at one point of their circumference, and grinding said articles during rotation by a grinding agency applied at another point of their circumference.

In testimony whereof, I have signed my name to this specification this 26th day of September, 1921.

LEWIS R. HEIM.