May 29, 1951 F. F. KLETT 2,554,830

ABRADING APPARATUS

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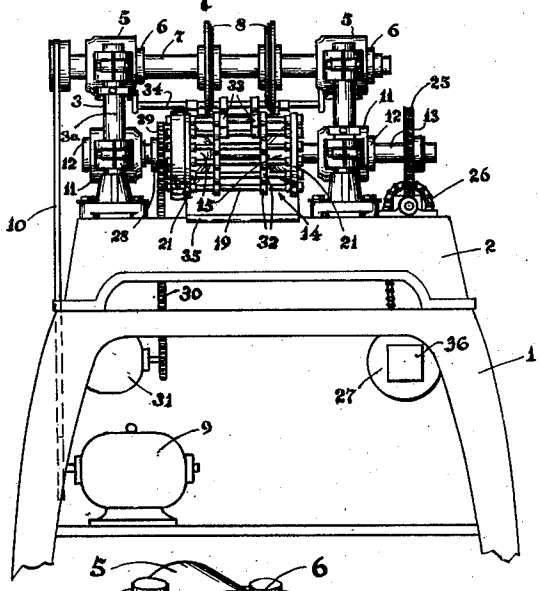
Fig. 1



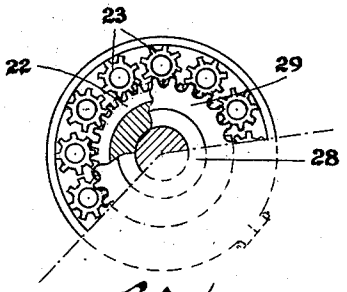


Fig. 4

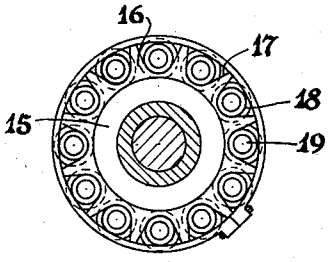


Fig. 5

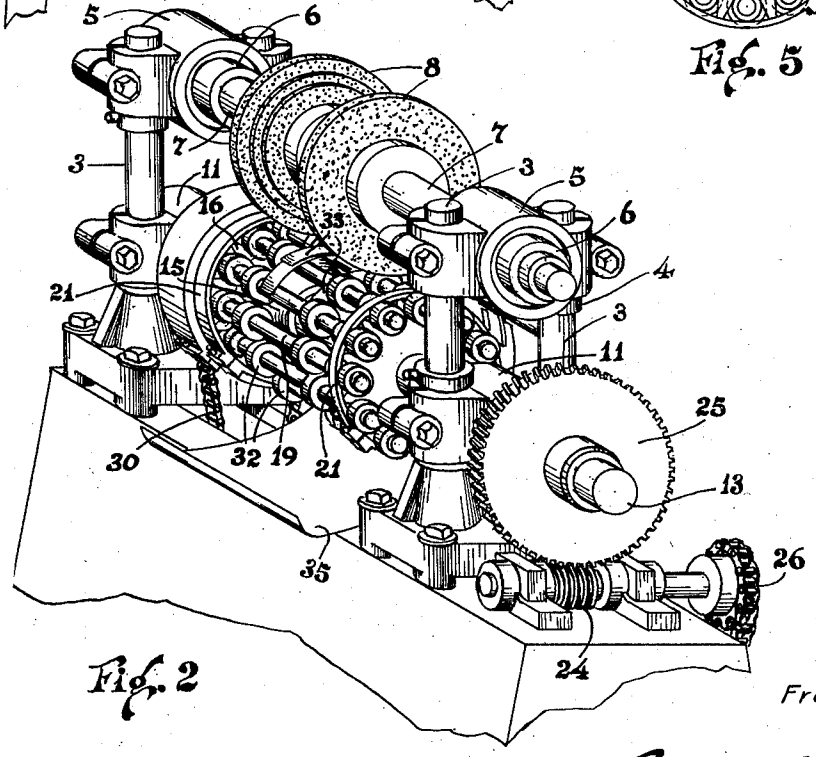


Fig. 2

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ABRADING APPARATUS

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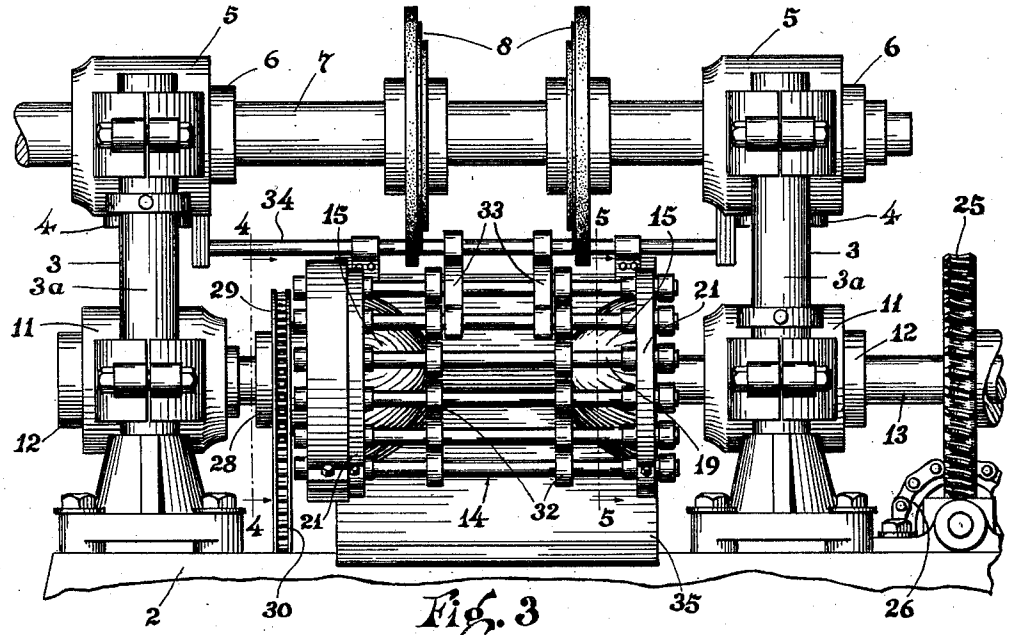

Fig. 3

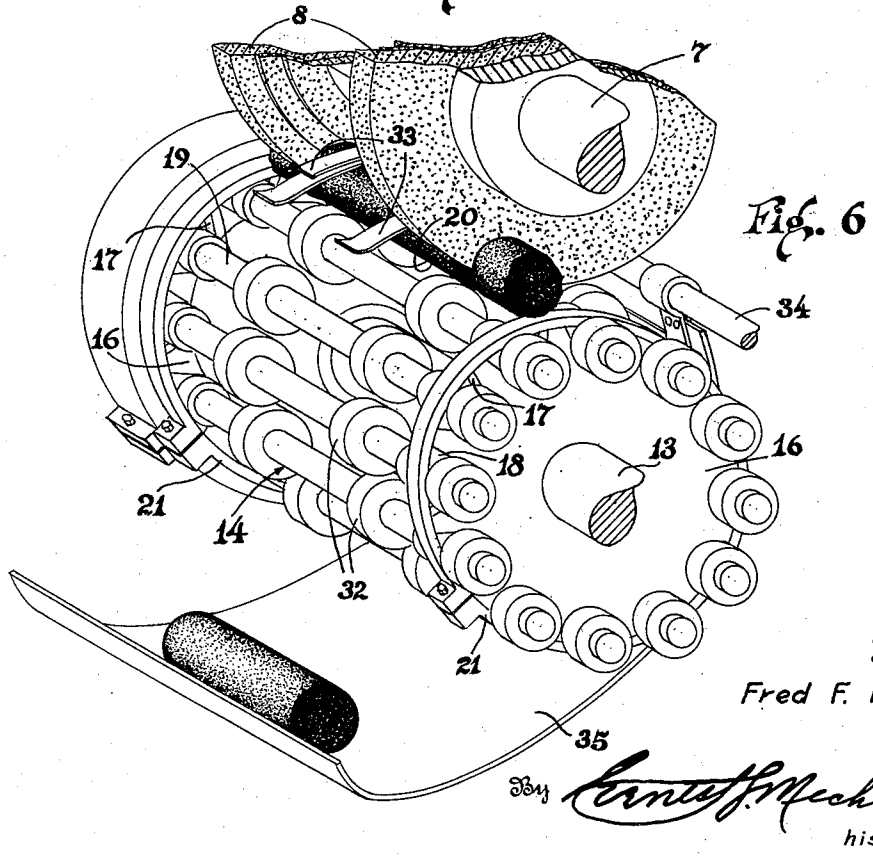

Fig. 6

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UNITED STATES PATENT OFFICE

2,554,830

ABRADING APPARATUS

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Application September 25, 1946, Serial No. 699,131

12 Claims. (Cl. 51—108)

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This invention relates generally to centerless grinding and particularly to apparatus for the centerless abrading or cutting of ceramic bodies. While the apparatus of the present invention is especially suited for use with ceramic bodies and will be so described for purposes of illustration, it will be evident that the invention has wide application in the centerless grinding art.

The manufacture of coil forms and other cylinder-like ceramic bodies for use as the insulating medium in radio coils and like applications has presented problems of unusual difficulty. Such bodies are generally fired before being used and in this condition are too hard and brittle to be abraded effectively. They must therefore be cut or abraded to the desired shape before firing while still in a relatively soft state. At this stage a ceramic blank is easily chipped, thus making it impossible to grind the blank on a normal centering lathe. Resort has therefore been had to centerless grinding for profiling and cutting ceramic blanks.

The primary object of the present invention is to provide improved apparatus for the centerless grinding of ceramic blanks by which blanks can be profiled and cut to the desired shapes without chipping or other breakage.

Another object of the invention is to provide improved apparatus for profiling and cutting ceramic blanks which can be adjusted for handling blanks of different size.

A further object of the invention is to provide improved apparatus for profiling and cutting ceramic blanks which is automatic in operation and capable of handling blanks of uniform size as a continuous process.

Other objects and features of the invention will appear hereinafter in the detailed description, be particularly pointed out in the appended claims and illustrated in the accompanying drawings in which:

Figure 1 is a side elevational view of a preferred embodiment of the invention showing the abrading apparatus mounted on a suitable support.

Figure 2 is an enlarged isometric view of the abrading apparatus.

Figure 3 is an enlarged side elevational view showing the details of construction of the blank-supporting drum and abrading wheels.

Figure 4 is a vertical sectional view taken along the lines 4—4 of Figure 3 with portions broken away and shown diagrammatically.

Figure 5 is a vertical sectional view taken along the lines 5—5 of Figure 3.

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Figure 6 is an enlarged isometric view of the central portion of Figure 2 illustrating in more detail the operation of the apparatus.

Referring now in detail to the drawings illustrating a preferred embodiment of the invention, in which like reference characters designate like parts, numeral 1 designates a suitable table or stand to which is attached a base or frame 2. Mounted on the base are a pair of supporting members or uprights 3 spaced longitudinally of the frame, each preferably comprising a pair of laterally spaced perpendicularly disposed pillars or posts 3a. Adjacent the upper ends of the posts and vertically adjustable relative thereto are a pair of collars 5 housing suitable bearings 6 in which are carried the abrading wheel shaft or axle 7, the latter mounting one or more abrading wheels 8. This shaft is adapted to be rotated at relatively high speed by a suitable motor 9 through a belt or other connection 10.

Mounted on the posts 4 between the abrading wheel shaft 7 and the base and also vertically adjustable relative to the posts are collars 11 housing suitable bearings 12 in which are journaled a work-supporting shaft or axle 13. This shaft is disposed beneath and parallel to the abrading wheel shaft 7 and intermediate the uprights 3 carries a drum or cylindrical carriage or cage 14 which is keyed or otherwise affixed to the shaft and rotatable therewith.

As shown in the drawings, the cage 14 may be formed by attaching, by keying or otherwise, to the work-supporting shaft 13, a pair of spaced hubs 15, each carrying and formed integrally with a star wheel 16. The peripheries of both of the star wheels 16 are slotted to provide a plurality of pairs of spaced aligned slots 17. Each of these pairs of slots is adapted to receive or seat bearings 18 in which are journaled the ends of the work-holding spindles, rollers or shafts 19. These spindles, which form the outside of the cage 14, are mounted parallel to the axis of the work-supporting shaft 13, and designed to operate adjacent to one another in such a manner as to eccentrically or exteriorly support a ceramic blank indicated diagrammatically at 20. The spindles may be secured or held in the slots 17 by split bands 21 or other suitable means encircling the star wheels 16 and enclosing the bearings 18.

The spindles 19 are adapted to carry the blanks 20 into engagement with the abrading wheels 8 and hold or support the blanks as they are cut or profiled. This they accomplish by rotating with

the work-supporting shaft 13. At the same time it is essential that the blanks be rotated during the period in which they are in engagement with the abrading wheels 8. To perform both of these functions the spindles must rotate simultaneously about their own axes and the axis of the drum.

To obtain rotation of the spindles independently of the rotation of the shaft 13 there is preferably provided a sun gear 22 mounted and freely rotatable on the shaft 13 adjacent one end of the cage 14. The sun gear is positioned to engage planetary gears 23 affixed to the adjacent ends of each of the spindles 19. The sun and planetary gears together form a gear train by which all of the spindles can be rotated in the same direction and at the same speed independently of the rotation of the shaft 13.

The supporting shaft 13 is rotated by attaching to one of its ends, outwardly of the uprights 3, a worm 24 adapted to enmesh with a worm gear 25, the latter being driven through a sprocket and chain 26 or like connection by suitable motor 27. Actuation of the sun gear 22 by which the spindles are independently rotated may be accomplished by providing on its hub 28 a sprocket or spur gear 29 connected by a chain 30 or a like means to a suitable motor 31. The abrading wheels 8 and spindles 19 are preferably rotated in the same direction and the cage 14 and the sun gear 22 in the opposite direction, the abrading wheels at relatively high speed, the drum at a comparatively low speed and the sun gear actuating the spindles at a speed greater than that of the drum in order to impart the required independent rotation to the spindles.

While it is possible to support a ceramic blank directly on the spindles 19 there are preferably provided spaced collars, discs or rollers 32 on each of the spindles on which the blanks are directly supported. To ensure that the blanks remain seated on their respective pairs of spindles as they approach and engage the abrading wheels it is desirable to provide work-holding fingers 33 adapted to engage the ceramic blanks during this portion of their travel. These fingers may be attached to the uprights 3 by appropriate means such as the hanger 34, the latter preferably being swingably attached to collars 4 carried by and vertically adjustable relative to the uprights 3 to enable clearance between the fingers and the spindles to be adjusted to accommodate blanks of different size.

The ceramic blanks from which the final coil forms or other insulating bodies are formed may be fed to the abrading apparatus by hand or from an appropriate feeding trough. In either case each blank is deposited on adjacent spindles just prior to the time when the latter enters the arc included by the fingers. The blanks are continuously fed into spaces between adjacent spindles as the latter reach the feeding point. After the blanks have passed under the abrading wheels and there have been profiled and cut to the desired configuration and size, they drop off into the outlet chute 35 which may be attached to the hanger 34 supporting the fingers 33. Through this chute the formed bodies are led from the apparatus.

As previously mentioned, both the abrading wheels 8, the fingers 33 and the drum 14 are independently adjustable vertically on the uprights 3. Thus the apparatus is enabled to handle ceramic blanks of different sizes and make cuts of different depths by adjusting the abrading wheels and fingers vertically relative to the drum to provide the desired spacing therebetween. In the illustrated embodiment the two abrading wheels in the position shown are set to cut a blank to a particular length. Any desired profiling or variations in cutting can of course be obtained by changing the setting as well as the number and configuration of the abrading wheels.

In addition to the vertical adjustment it may also be necessary to vary the speed of rotation of the drum with different size blanks to afford time for the abrading wheels to complete their profiling and cutting. As has been pointed out heretofore, sufficient time for these operations will normally be allowed by turning the drum at a low speed relative to that of the abrading wheels. However, in some instances it may be desirable to cause the drum to dwell as each blank reaches abrading position, in which case an appropriate time-controlling device 36 can be attached to the apparatus to cause the drum to stop at predetermined intervals. The other rotating members of the apparatus, the spindles 18 are rotated in the same direction as the abrading wheels 8 and at such relative speed that the peripheral speeds of the wheels and the blanks will be different, thus providing for most efficient abrading.

From the above detailed description it will be apparent that there has been provided an improved apparatus of rugged construction particularly adapted for the cutting and profiling of ceramic blanks as a continuous operation. While a single embodiment of the apparatus has been illustrated and described it will be understood that this embodiment is merely exemplary of the invention and that all modifications are intended to be included that depart neither from the spirit of the invention nor the scope of the appended claims.

I claim:

1. Abrading apparatus comprising a rotatable drum, a plurality of blank-holding spindles rotatably mounted around the periphery of said drum and rotatable therewith, a rotary abrading wheel associated with said drum, said spindles being adapted to eccentrically support work blanks and move said blanks into engagement with said abrading wheel, and means for rotating said spindles independently of said drum and turning said blanks while the latter are in engagement with said abrading wheel.

2. Abrading apparatus comprising spaced uprights mounted on a base, an abrading wheel mounted on a shaft rotatably carried by said uprights and vertically adjustable relative thereto, a drum rotatably mounted on said uprights beneath said abrading wheel, a plurality of blank-holding spindles rotatably mounted around the periphery of said drum and rotatable therewith, adjacent of said spindles being adapted to move a blank into engagement with abrading wheel, means for rotating said abrading wheel and drum, and means for rotating said spindles independently of said drum and turning said blanks while the latter are in engagement with said abrading wheel.

3. Abrading apparatus comprising a rotatable drum, a plurality of blank-holding spindles rotatably mounted around the periphery of said drum and rotatable therewith, a rotary abrading wheel associated with said drum, means for rotating said abrading wheel and drum, adjacent of said spindles cooperating to move a blank into engagement with said wheel on rotation of said drum, means for rotating said spindles inde-

pendently of said drum and turning said blanks while the latter are in engagement with said abrading wheel, and means for varying the clearance between said spindles and said abrading wheel.

4. Abrading apparatus comprising a rotatable drum, a plurality of blank-holding spindles rotatably mounted around the periphery of said drum and a rotary abrading wheel associated with said drum, said spindles being adapted to eccentrically support said blanks and move said blanks into engagement with said abrading wheel on rotation of said drum, means for rotating said abrading wheel at a relatively high speed, means for rotating said drum at a relatively low speed, and means for rotating said spindles independently of said drum and turning said blanks at a peripheral speed different from that of said abrading wheel.

5. Abrading apparatus comprising an abrading wheel, a drum mounted on an axis parallel to the axis of said wheel, means for rotating said wheel and drum at relatively different speeds, a plurality of pairs of blank-holding spindles rotatably mounted on said drum, each of said pairs of spindles cooperating to move a blank into engagement with said abrading wheel on rotation of said drum, a resilient finger associated with said drum and adapted to maintain said blanks in position on said spindles, and means for rotating said spindles independently of said drum and turning said blanks while the latter are in engagement with said abrading wheel.

6. Abrading apparatus comprising an abrading wheel, a drum mounted on an axis parallel to the axis of said wheel, means for rotating said wheel and drum at relatively different speeds, a plurality of blank-holding spindles rotatably mounted on said drum, adjacent of said spindles cooperating to move blanks into engagement with said abrading wheel on rotation of said drum, a resilient finger associated with said drum and adapted to maintain said blanks in position on said spindles, means for rotating said spindles independently of said drum and turning said blanks while the latter are in engagement with said abrading wheel, and means for varying the clearance between said spindles and said abrading wheel.

7. Abrading apparatus comprising a shaft rotatably mounted between a pair of spaced uprights and carrying an abrading wheel, a drum rotatably mounted on said uprights beneath said abrading wheel, a plurality of blank-holding spindles rotatably mounted around the periphery of said drum, adjacent of said spindles being adapted to move a blank into engagement with said abrading wheel, means for rotating said abrading wheel, means for interruptedly rotating said drum causing said blanks to dwell beneath said abrading wheel, and means for rotating said spindles independently of said drum and turning said blanks while the latter are in engagement with said abrading wheel, said shaft being vertically adjustable relative to said drum for varying the clearance between said abrading wheel and said spindles.

8. In an abrading apparatus a rotatable carriage, means rotatably mounted on said carriage and rotatable therewith for exterially supporting work on an exterior of said means and means for rotating said supporting means and thereby turning said work relative to said carriage.

9. In an abrading apparatus a rotatable carriage, a plurality of spindles rotatably mounted on said carriage and rotatable therewith on rotation therewith, adjacent of said spindles cooperating to support and hold a work blank, and means for rotating said spindles independently of the rotation of said carriage and thereby turning said blank.

10. Abrading apparatus comprising a rotatable drum, a rotatable abrading wheel associated with said drum, means for rotating said drum and abrading wheel, supporting means rotatably mounted about the periphery of said drum and rotatable therewith on rotation of said drum, said supporting means supporting work on an exterior thereof, and means for rotating said supporting means, and thereby turning said work relative to said drum on presentation of said work to said abrading wheel.

11. Abrading apparatus comprising a rotary abrading wheel, a carriage spaced from and rotatable on an axis parallel to the axis of said wheel, a plurality of spindles rotatably mounted on said carriage and rotatable therewith on rotation thereof, adjacent of said spindles cooperating to support and hold a work blank in engagement with said abrading wheel, and means for rotating said spindles independently of the rotation of said carriage, and thereby turning said blank.

12. Abrading apparatus comprising a shaft carrying an abrading wheel, a drum rotatable about an axis parallel to the axis of said shaft, a plurality of spindles rotatably mounted around the periphery of said drum and rotatable therewith, said spindles being adapted to support blanks on exteriors of said spindles and to move said blanks into abrading wheel engaging position, and means for rotating said spindles, and thereby turning said blanks relative to said spindles and drum while said blanks are in wheel engaging position.

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