March 13, 1945. R. V. HANCHETT 2,371,582

GRINDING APPARATUS

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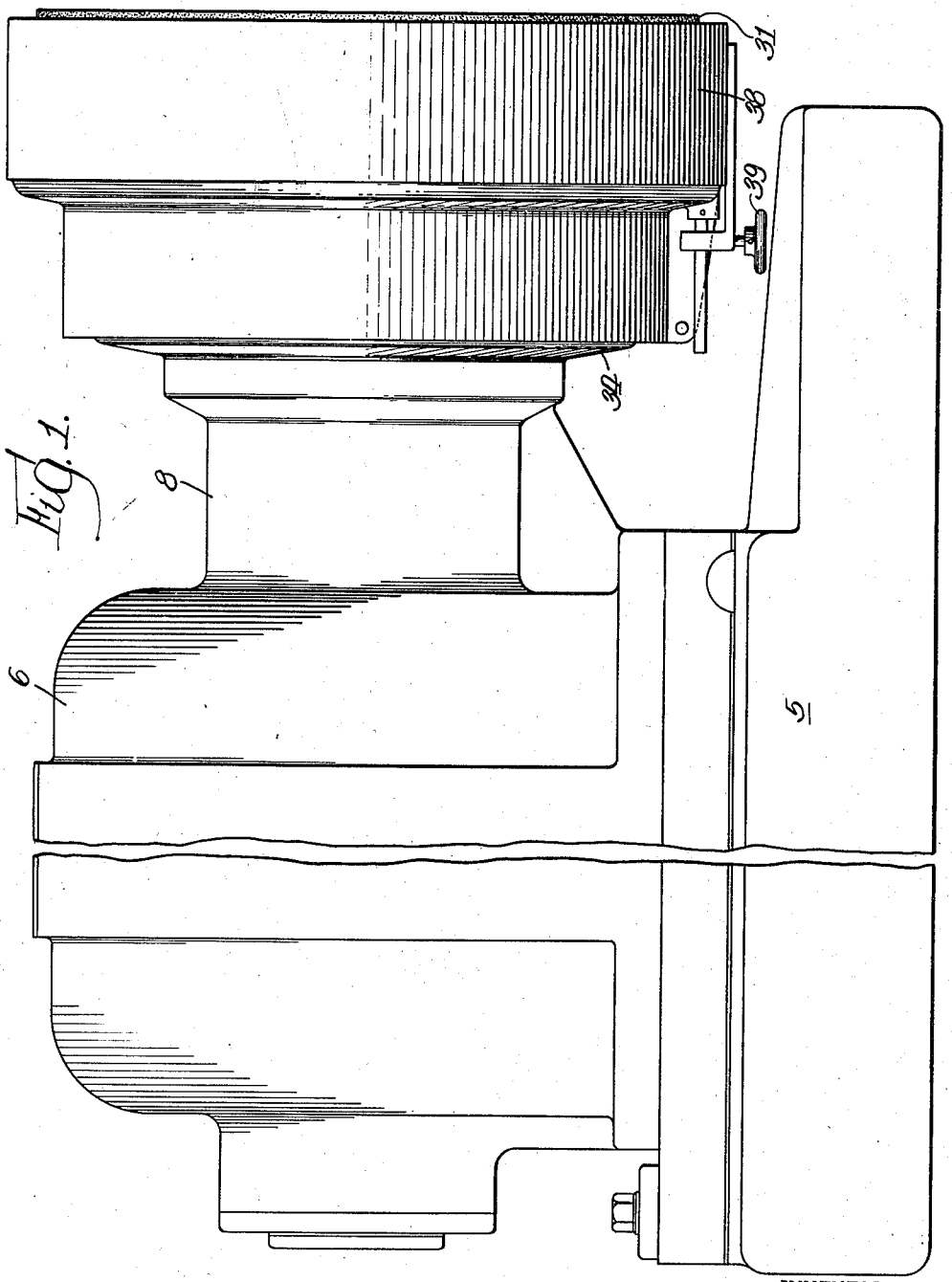

Fig. 1.

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Fig. 2.

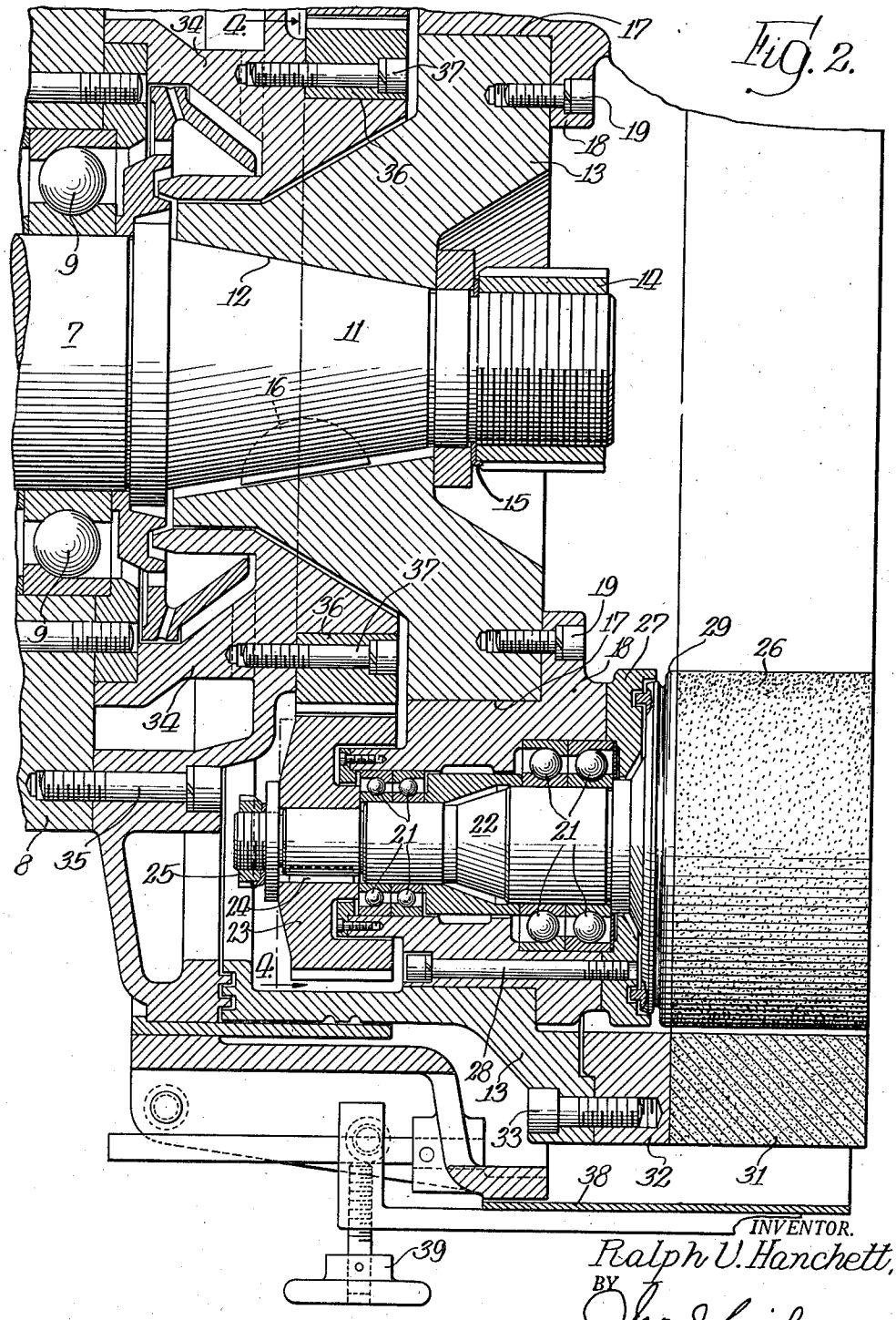

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Fig. 3.

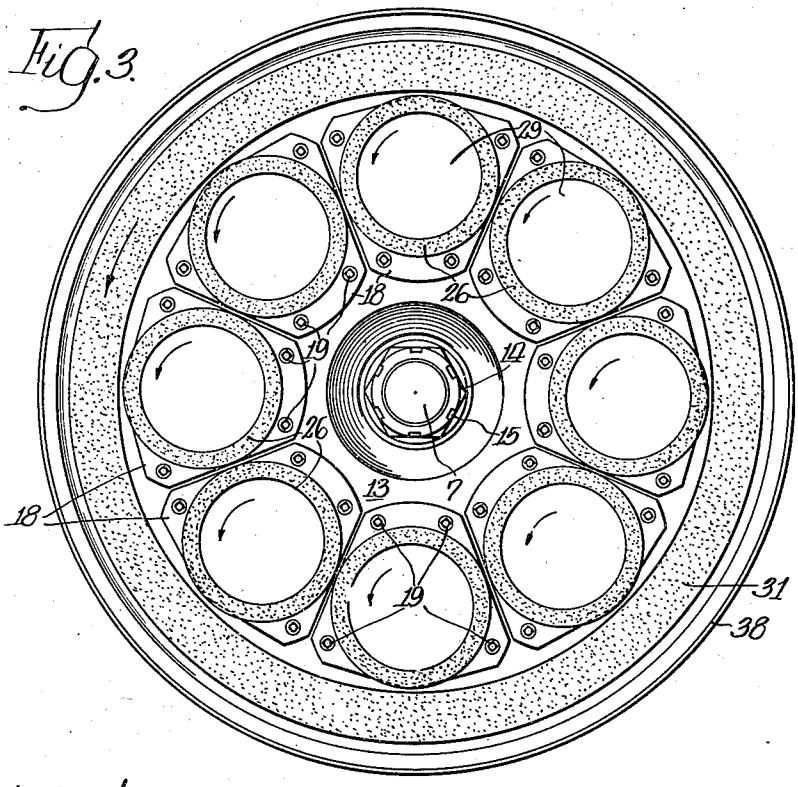
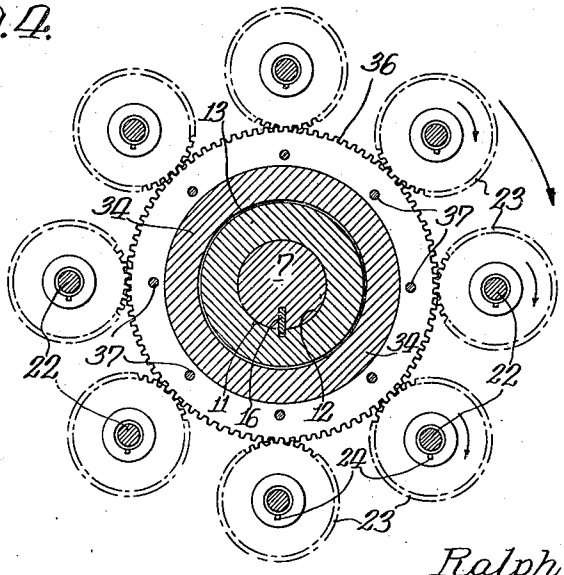


Fig. 4.



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UNITED STATES PATENT OFFICE

2,371,582

GRINDING APPARATUS

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Application March 8, 1944, Serial No. 525,504

2 Claims. (Cl. 51—120)

This invention relates to apparatus for the surface grinding of parts, and aims to provide an apparatus which will accurately grind with greater rapidity than apparatus heretofore employed for similar purposes.

For the type of grinding for which my present apparatus is designed, it has been customary to employ a grinding wheel of the cylinder or ring type presenting one or more concentric grinding surfaces across or relatively to which the work being ground was moved as the wheel was revolved. In some instances the abrasive of the grinding wheel, instead of being formed in one or more continuous rings, was made of a group of segments carried in a chuck and spaced apart so as to afford clearance between adjacent segments. The segmental type permits the escape of coolant between adjacent segments and is believed to run cooler and cut more freely than the continuous ring type.

My present invention is an improvement upon the segmental type of grinder in that the abrasive grinding elements, corresponding in spacing to the heretofore mentioned segments, consists each of an individually rotatable element of any desired shape, such for instance as a cylinder or ring. A plurality of these elements are mounted upon a spindle carried on a revoluble head, so that the elements revolve in an orbit or orbits concentric with the spindle axis while they simultaneously rotate about their respective axes. This spacing of the elements, together with their orbital revolution in conjunction with their individual rotative movements, produces a grinding action which is highly efficient and rapid, while at the same time the elements are maintained in a workably cool condition due to the air circulation around and between them.

In addition to the revoluble and individually rotatable abrasive elements above mentioned, my invention contemplates the employment of a surrounding continuous abrasive wheel of the cylinder or ring type having its grinding face in the same plane as the grinding faces of said individual elements. This large solid wheel is designed to receive the initial pressure of the work and the individual elements will continue with the grinding in the same plane as the work is passed across the face of the tool as a whole.

Other objects and advantages of the invention will be apparent as the same becomes better understood by reference to the following description when considered in connection with the accompanying drawings.

Referring to the drawings,

Fig. 1 is a broken side elevation of one type of apparatus embodying my invention;

Fig. 2 is a fragmentary longitudinal sectional view through the grinding apparatus per se;

Fig. 3 is an end elevation looking toward the left at Figs. 1 and 3; and

Fig. 4 is a sectional view on the line 4—4 of Fig. 2.

My improved grinding apparatus is capable of incorporation in grinding machines of various types and designs. Merely for the purpose of illustrating the principles of my invention, I have here illustrated the same as embodied in a very simple type of machine consisting essentially of a bed or base 5 upon which is mounted an electric motor 6 having an extending shaft or spindle 7 contained in a supporting housing 8 projecting from the motor and equipped with suitable bearings, such as ball bearings, 9 in which the spindle is journaled.

The grinding apparatus per se of my invention is carried by and is rotatable with the spindle. As illustrated, the end portion 11 of the spindle is tapered to snugly fit the tapered bore 12 of a head 13 whch is locked on the spindle by a nut 14 and lock washer 15 and is locked against rotation relatively to the spindle by a key 16.

The head, which is circular in form, is provided with a series of axially extending bores or openings 17, each adapted to receive a spindle housing 18 which is secured in position by a plurality of fastening bolts 19. Each spindle housing 18 carries a plurality of sets of ball bearings 21 in which is journaled a spindle 22 upon the inner end of which a pinion 23 is mounted and to which it is rigidly locked by a key 24 and a lock nut 25.

Upon the outer end of each of the spindles 22 there is fixedly secured by suitable means an abrasive element 26 here shown as of hollow cylindrical form presenting at its outer end an annular or ring-like grinding surface, although my invention contemplates the employment of a solid block of abrasive of any desired shape other than circular. A ring 27 secured to the housing 18 by a plurality of bolts 28 serves to retain the various parts in assembled relation. Each abrasive element 26 of whatever form or shape is mounted in a well known manner upon an annular base 29.

Upon the marginal portion of the head face 13 surrounding the spindle housing 18 there is mounted a large annular abrasive member 31 provided with a metal ring 32 which is secured to the head 13 by a series of bolts 33. The outer

edge which constitutes the grinding face of this member is disposed in a plane perpendicular to the spindle 7 and spindles 22 which includes the grinding faces of all of the abrasive elements 26.

For some types of work the spindles carrying the abrasive elements 26 may be permitted to rotate freely under the influence of the revolving head and the work contacting the elements. When such is the case the elements may or may not rotate in unison as they revolve with the head. In some instances, however, it seems preferable to positively control the rotation of the abrasive elements and cause them to rotate on their individual axes at a common and uniform speed. In the form of apparatus here illustrated provision is made for thus positively rotating and controlling the elements. This construction will now be described.

The end cap 34 of the spindle bearing housing 8 is secured thereto by a series of bolts 35 and is shaped so as to be disposed between this stationary housing and the rotating head 13. A ring gear 36 is secured to the end cap 34 by a plurality of bolts 37 so that it is disposed concentrically with the main spindle 7 in position to mesh with and impart rotation to the pinions 23 as they, together with their respective spindles and attached abrasive elements are revolved about the axis of the spindle 7 upon rotation of the head 13 with the spindle.

A cylindrical protecting guard 38 is carried by the stationary bearing cap 34 in position to surround and guard the grinding member 31, and this guard may be adjusted longitudinally of the spindle to dispose its outer edge in desired relation to the plane of the cutting faces of the abrasive elements by suitable adjusting mechanism including a hand wheel 39.

In operation the main spindle 7 is rotated by the motor 6 so as to rapidly revolve the head 13 carrying with it the large annular grinding member 31 and the plurality of smaller grinding elements 26. The elements 26, as they are revolved about the axis of the spindle 7 with the head 13, are either individually freely rotatable or are simultaneously rotated, each about its individual spindle axis by reason of the driving engagement of the pinions 23 with the stationary ring gear 36. The grinding apparatus, therefore, presents in a plane perpendicular to the axis of the main spindle a large circumferential ring grinder surrounding a series of individually rotating grinding elements, all revolving concentrically with the large ring grinding member. The work to be ground is passed across the face of the abrasive elements, contacting first the grinding face of the large grinder and then successively the small rotating grinders. The grinding action of the individually rotating and simultaneously revolving abrasive elements is very rapid and efficient and the spacing of these elements permitting the circulation of coolant enables the apparatus as a whole to operate at a lower temperature and much more efficiently than with the solid grinders or the segmental grinders heretofore employed.

The structural details illustrated and described may obviously be varied within considerable limits within the scope of my invention as defined in the following claims.

I claim:

1. A grinding apparatus, comprising a rotatable spindle, a head fixed on said spindle, a hollow cylindrical abrasive member mounted on said head concentrically with said spindle, a plurality of individually rotatable abrasive elements carried by said head within the confines of said member, and means for imparting individual rotation to said elements upon revolution of said elements with the head about the axis of said spindle.

2. In a grinding apparatus, the combination of a rotatable head, a plurality of spindle bearing housings mounted on said head, a spindle rotatably mounted in each of said housings, said spindles being disposed parallel with the axis of rotation of said head, an abrasive element mounted upon each of said spindles, a pinion mounted upon each spindle, a stationary gear ring meshing with said pinions, an abrasive member mounted upon said head and encircling said abrasive elements, and means for revolving said head to thereby effect a simultaneous revolution of said elements about a common axis and an individual rotation of each element about its respective spindle axis.

RALPH V. HANCHETT.