Oct. 25, 1949. B. A. STROUT 2,485,786

ROTARY ABRADING TOOL

Filed March 19, 1948 2 Sheets-Sheet 1

Fig. 1

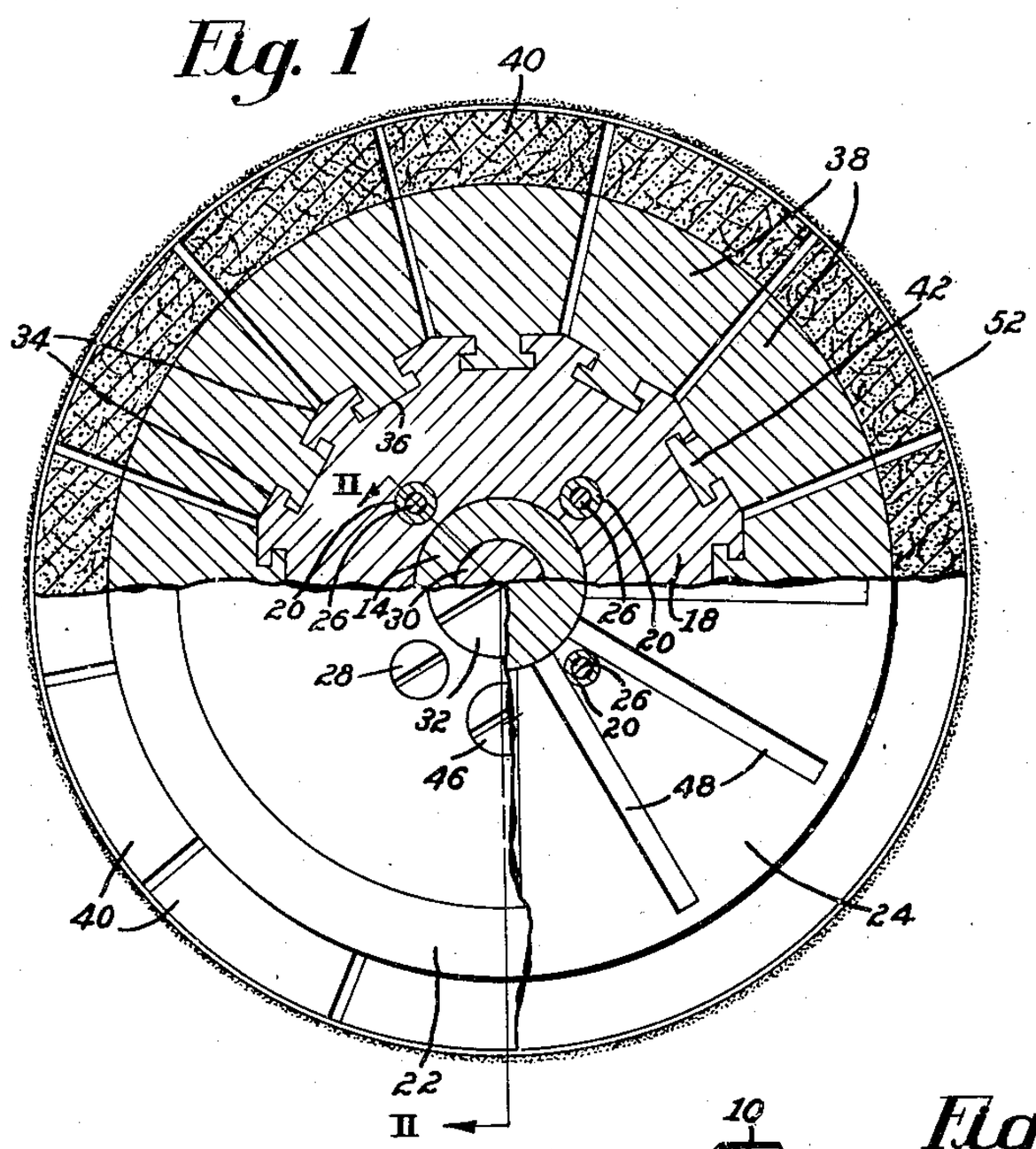


Fig. 2

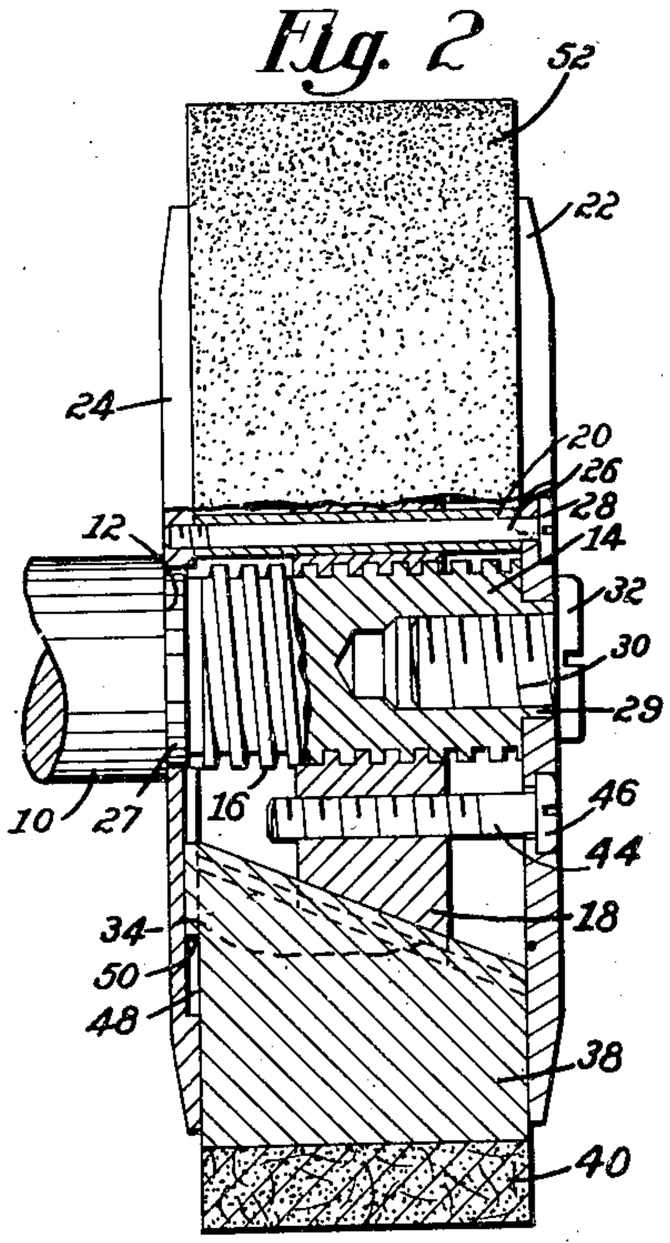
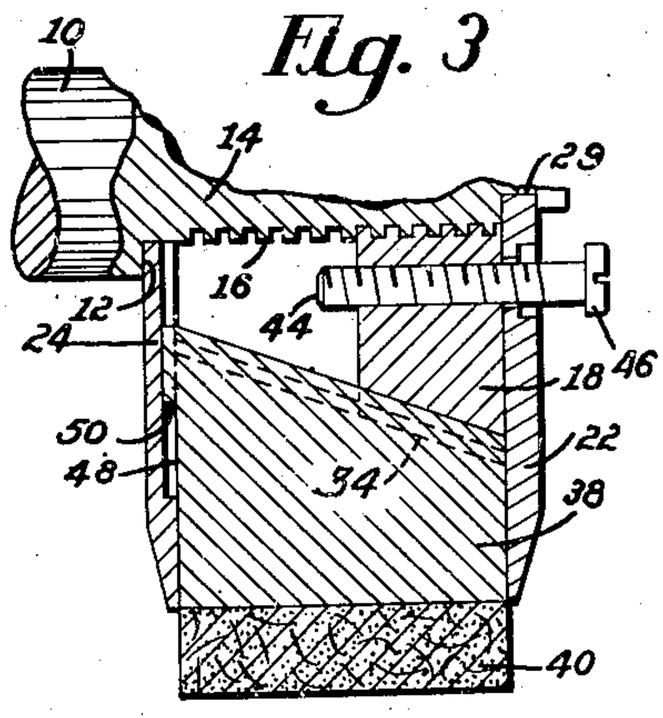


Fig. 3



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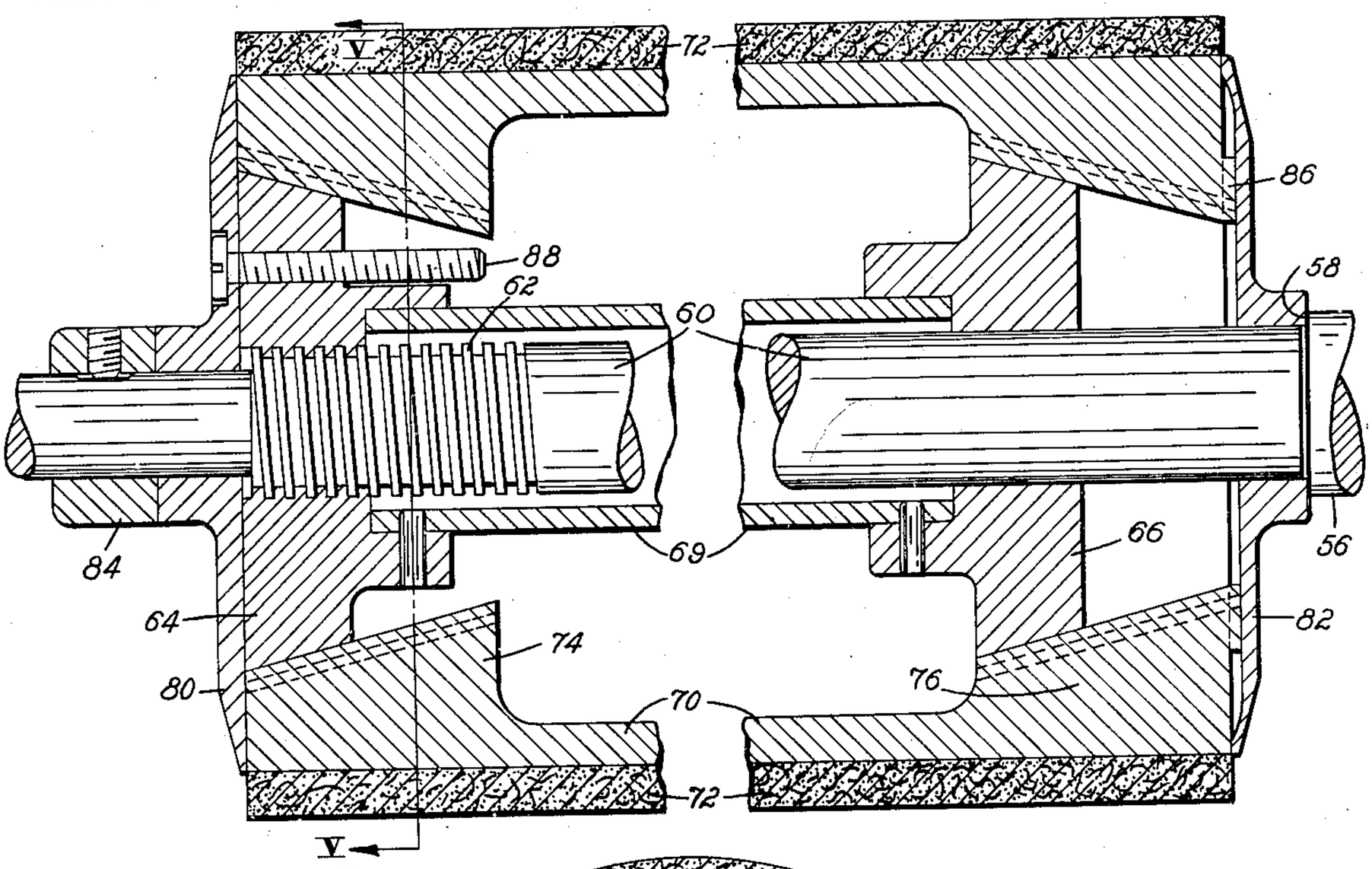

Fig. 4.

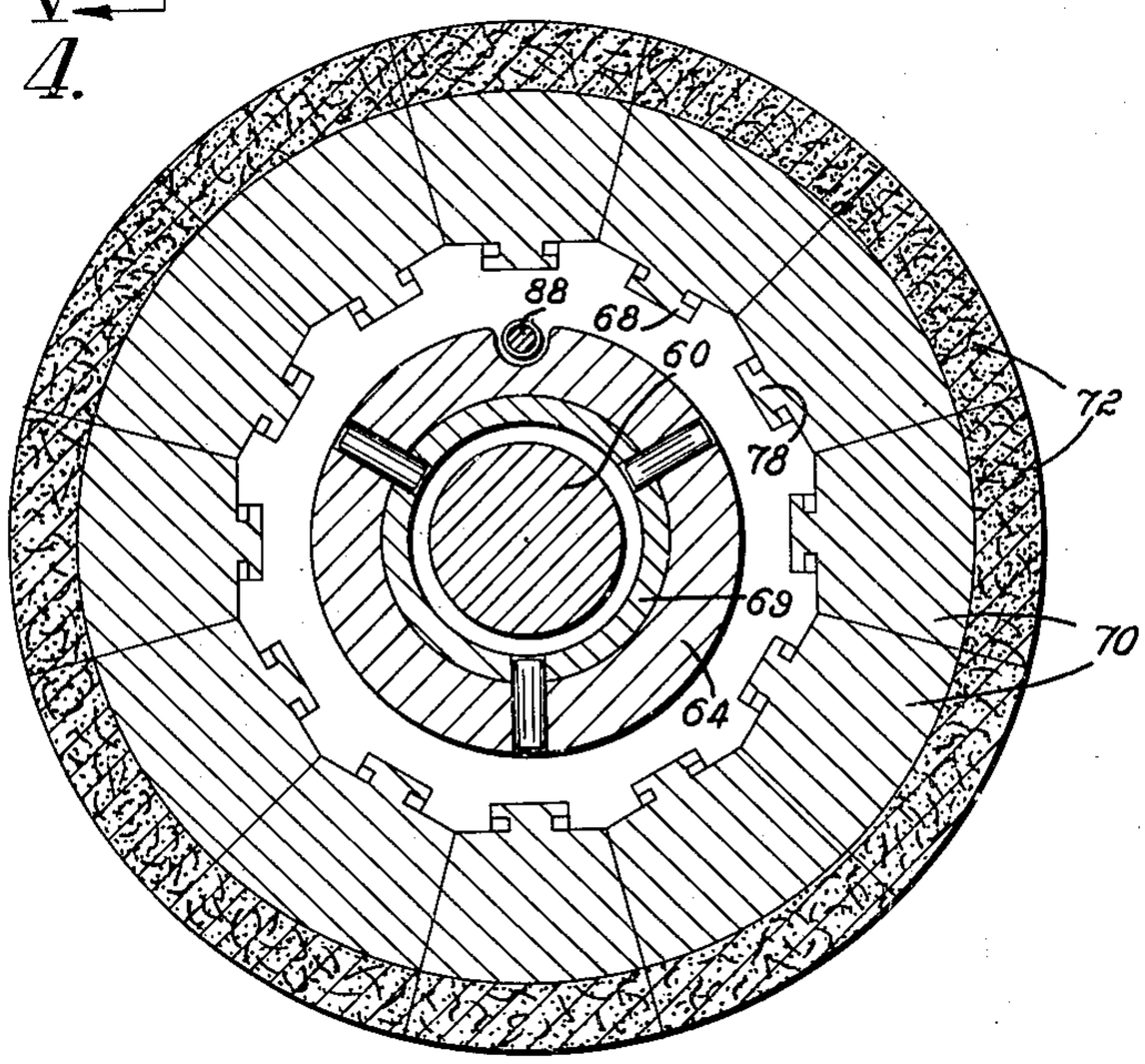

Fig. 5.

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UNITED STATES PATENT OFFICE

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ROTARY ABRADING TOOL

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12 Claims. (Cl. 51—190)

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This invention relates to rotary abrading tools and is herein disclosed as embodied in such a tool having a body portion which is expansible to enable it to grip internally an endless band of abrasive sheet material. Some difficulties have been encountered in the use of expansible tools because of the fact that they may not expand uniformly and they are therefore likely to become unbalanced when run at high speed.

It is an object of this invention to provide a tool of the type under consideration which is adapted to run in balance at high speed. In accordance with a feature of the invention, the expansible body of the illustrated tool is made up of a plurality of sectors which are expanded by the wedging action of a nut threaded on a shaft upon which the tool is mounted, the sectors meanwhile being held against partaking of the axial movement of the nut. Each sector has a sliding interlocking keyed connection to a member which holds the sector against uncontrolled outward movement which might otherwise result from centrifugal force. The extent of the expansion of the sectors is limited by a stop screw threaded through the nut and engageable with a member held against axial movement with respect to the shaft. The torque resulting from the frictional drag of the work is transmitted through the sectors to the nut to cause the nut to hold the sectors radially expanded.

The invention further consists of various features of construction and combinations and arrangements of parts herein shown and claimed, the advantages of which will be apparent to those skilled in the art from the following description, reference being had to the accompanying drawings, in which

Fig. 1 is an end elevation, partly in section, showing an illustrative abrading tool in the form of a heel scouring wheel embodying the invention;

Fig. 2 is a side elevation of the illustrative abrading tool in expanded condition, a portion of this figure consisting of a sectional view taken on the line II—II of Fig. 1;

Fig. 3 is a sectional view of a portion of the tool showing the tool in contracted condition;

Fig. 4 is a sectional view, taken along the axis, of a shoe bottom buffing roll embodying the invention; and

Fig. 5 is a cross sectional view of the roll shown in Fig. 4.

The heel scouring wheel illustrated in Figs. 1, 2, and 3 is adapted for mounting upon a rotary driven shaft 10 having a shoulder 12 from which

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extends a reduced portion 14. Formed upon the reduced portion 14 is a screw thread 16 upon which is threaded a nut 18. Formed in the nut 18 and extending parallel to the axis thereof are four symmetrically spaced holes each of which slidably engages a spacing sleeve 20. These spacing sleeves are interposed between a pair of parallel disks 22 and 24 to maintain the disks in spaced relation to each other. Extending through each of the spacing sleeves 20 is a clamping screw 26 having one of its ends threaded into the disk 24 and having at its opposite end a head 28 which engages a countersunk recess in the disk 22. When the screws 26 are tightened they serve to bind the disks 22 and 24 and the sleeves 20 into a unitary assembly. This assembly is mounted on the shaft 10, with a central opening of the disk 24 fitting over a cylindrical unthreaded bearing surface 27 on the reduced portion 14 adjacent to the shoulder 12 and with a central opening of the disk 22 fitting over a bearing formed by an end portion 29 of the shaft 10 which has been reduced to a diameter still less than that of the reduced portion 14. A screw 30 threaded axially into the end of the shaft 10 has a head 32 which retains the disk 22, and therefore the assembly, on the shaft. The screw head 32 bears against the end of the shaft 10 without clamping the disk 22, and the disks 24 and 22 are free to turn as a unit about their respective bearings 27 and 29; they are, however, held against axial movement on the shaft by the shoulder 12 and the screw head 32 respectively. The nut 18 and the unitary assembly above referred to are held against relative rotation by the engagement of the sleeves 20 with the holes in the nut.

The nut 18 has a thickness, measured in the direction of the axis of the nut, which is considerably less than the distance between the inner faces of the disks 22 and 24 and the nut, therefore, as it is turned upon the thread 16 is free to travel axially with respect to the unitary assembly above mentioned. The periphery of the nut 18 is in the form of a frustum of a pyramid having twelve equal faces 34 and the peripheral surface of the nut is therefore beveled. Formed in each of the faces 34 is a keyway or undercut groove 36 which is T-shaped in cross section and which extends, longitudinally, in the direction of an element of the pyramid above referred to.

The body portion of the heel scouring wheel is made up of twelve individual aluminum sectors 38 each of which has a cushion 40 of felt, rubber, or like material upon its periphery. Each

of these sectors has an inner face which slides upon and which is inclined or beveled complementally to an associated frusto-pyramidal face 34 of the nut 18. Extending from the inner face of each sector 38 is an integral key or tongue 42 which in cross section is T-shaped and which slidably engages one of the keyways 36, each sector 38 being thus mounted on the nut 18. It is evident that axial movement of the nut in one direction will expand the sectors by wedging action and that movement in the opposite direction will contract the sectors. The end disks 22 and 24 hold the sectors 38 against axial displacement relative to each other and to the shaft 10. The axial component of thrust of the nut 18 in expanding the sectors is resisted by the end disk 24.

To prevent excessive expansion of the tool, a screw 44 is threaded through the nut 18 in a direction parallel to the axis of the tool. The screw 44 has a head 46 which is received within a countersunk recess in the disk 22. When the tool is in contracted position, as shown in Fig. 3, the screw head 46 extends out beyond the face of the disk 22. The nut 18 may now be rotated to bring it from the position shown in Fig. 3 into the position shown in Fig. 2, thereby expanding the tool to an extent limited by the setting of the head 46 within its recess.

Formed in the inner face of the disk 24 are twelve radial grooves 48, each of which engages a radially extending tongue 50 on one of the sectors 38 to guide the sector in its movements of expansion and contraction. The grooves 48 and tongues 50 transmit driving torque into the sectors 38 and prevent binding of the tongues 42 in the keyways 36.

The periphery of the tool made up by the sectors 38 may be cylindrical, as shown herein, or it may be in the form of any other surface of revolution. Upon this periphery is mounted an endless band 52 of abrasive sheet material.

In the operation of this device the shaft 10 is driven in such a direction as to cause the frictional drag of the work transmitted through the sectors 38 to hold the nut 18 in its expanded position as far as permitted by the stop screw 44. To replace the abrasive band 52 when the latter has become worn, the rotation of the shaft 10 is stopped and the operator turns the tool by hand in a direction to loosen the nut from the position shown in Fig. 2 to that shown in Fig. 3, thereby contracting the tool to a smaller diameter. The worn abrasive cover may then be removed and replaced by a fresh one, whereupon the operator turns the tool upon its shaft to expand the tool into cover-gripping condition. The abrasive band 52 is thus always gripped internally upon the periphery of the tool body while in operation. The screw 44 may be adjusted to provide greater or less tension, as desired, in the abrasive cover and, when the abrasive cover is composed of tough material such as emery cloth, the screw 44 may be removed and the full tension resulting from the frictional drag of the work may be permitted to develop.

It will be observed that the brading tool herein disclosed is free of clamping hooks or other devices for securing the abrasive cover which might damage the work. The worn abrasive covers can be readily and conveniently removed and replaced by fresh ones, and in the replacing of an abrasive cover the screw 44 can be adjusted to accommodate any inaccuracy of size of the cover and also to provide any desired degree of tension to prevent wrinkling of the cover while in operation. The interlocking engagement of the tongues 42 with the keyways 36 holds the sectors 38 positively against centrifugal force and thus insures against any danger of the tool getting out of balance by unsymmetrical expansion or flying apart when run at high speed. The expansion resulting from the wedging action of the nut 18 is positive, uniform for the various sectors, and accurately controlled to maintain a desired tension in the abrasive cover and perfect balance in the tool regardless of the speed at which the tool is run.

When it is desired to provide a rotary abrading tool that is relatively long in relation to its diameter, the construction illustrated in Figs. 4 and 5 should be used. As shown in these figures, a rotary driven shaft 56 has a shoulder 58 beyond which extends a reduced portion 60 having a screw thread 62 on which is threaded a nut 64. Slidably and rotatably mounted upon a smooth portion of the reduced shaft extension 60 is a wedge 66 which, except for the fact that it is unthreaded, is similar to the nut 64. The nut 64 and the wedge 66 have frusto-pyramidal peripheries similar in all respects to the periphery of the nut 18, and similarly provided with undercut keyways 68 like the keyways 36. Rigidly connecting the nut 64 and the wedge 66 and loosely surrounding the reduced extension 60 is a sleeve 69 which is pinned at one end to the nut 64 and at the other end to the wedge 66. The nut 64, the sleeve 69, and the wedge 66 thus constitute a unitary assembly.

The body portion of the long shoe bottom buffing roll shown in Figs. 4 and 5 is made up of twelve individual aluminum sectors 70 each of which has a felt or rubber cushion 72 upon its periphery for supporting an endless band or sleeve of abrasive sheet material. Each sector 70 consists of a long intermediate portion extending parallel to the shaft extension 60, an inwardly extending portion 74 adjacent to one of its ends, and an inwardly extending portion 76 adjacent to its other end. These portions 74 and 76 have inner faces which are similar to the inner faces of the sectors 38 and which are provided with similar tongues or keys 78 for interlockingly engaging the keyways 68.

Axial movement of the sectors 70 on the shaft is prevented by a pair of end disks 80 and 82 engaging the opposite end faces of the sectors and having hubs which are slidably and rotatably mounted on the reduced shaft extension 60. The hub of the disk 82 abuts the shoulder 58 and the hub of the disk 80 abuts a collar 84 secured to the shaft extension 60 by a set screw. The disk 82 has radial grooves which are slidably engaged by tongues 86 on the adjacent end faces of the sectors 70 to insure a uniform distribution of the driving torque among the sectors. Excessive expansion of the tool illustrated in Figs. 4 and 5 is limited by a screw 88 similar to the screw 44 and threaded into the nut 64.

The tool illustrated in Figs. 4 and 5 is similar in its principle of operation to the tool illustrated in Figs. 4 and 5 and it differs therefrom mainly by reason of the fact that its expansion is effected and controlled by a pair of spaced members operating upon the end portions of the tool body rather than by a single member.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a rotary abrading tool, an expansible tool body having a periphery adapted to carry an

endless band of abrasive sheet material, a rotary shaft, a nut threaded on said shaft, said nut and said tool body having complementally beveled engaging surfaces arranged to cause the tool body to be expanded by wedging action of the nut when the nut is turned on the shaft, and means for holding the tool body against axial movement relative to the shaft.

2. In a rotary abrading tool, an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft, means for holding the tool body against axial movement relative to the shaft, a nut threaded on the shaft, said nut and said tool body having complementally beveled engaging surfaces arranged to cause the tool body to be expanded by wedging action of the nut when the nut is turned on the shaft, and means for preventing relative turning of the tool body and the nut, whereby the torque resulting from the frictional drag of the work is transmitted through the tool body to the nut, tending to move the nut axially on the shaft and thereby maintain the tool body expanded.

3. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with the sectors, a nut threaded on said shaft, said nut and said sectors having complementally beveled engaging surfaces arranged to cause the nut to wedge the sectors outwardly from their common axis to grip the abrasive band internally upon relative axial movement between the nut and the sectors, and means for holding the sectors against axial movement while the nut is being turned on the shaft to expand the sectors radially.

4. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with the sectors, a nut threaded on said shaft, each sector having a sliding interlocking keyed connection to said nut arranged to urge the sector radially outward by wedging action of the nut when the nut is turned upon the shaft, and means for holding the sectors against axial movement while the nut is being turned to expand the sectors radially.

5. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with the sectors, means for holding the sectors against axial movement relative to the shaft, a nut threaded on the shaft, said nut and said sectors having complementally beveled engaging surfaces arranged to wedge the sectors outwardly from the axis of the shaft to grip the abrasive band internally upon relative axial movement between the nut and the sectors, and means for preventing relative rotation between the nut and the sectors about the axis of the shaft, whereby the torque resulting from the frictional drag of the work is transmitted through the sectors to the nut to cause the nut to hold the sectors radially expanded.

6. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with the sectors, a pair of disks engaging the opposite end faces of the sectors, means engageable with the disks to prevent the assembly

of disks and sectors from moving axially of the shaft, a nut threaded on the shaft, said nut and said sectors having complementally beveled engaging surfaces arranged to wedge the sectors outwardly from the axis of the shaft to grip the abrasive band internally upon relative axial movement between the nut and the sectors, and means for preventing relative rotation between the nut and the sectors about the axis of the shaft, whereby the torque resulting from the frictional drag of the work is transmitted through the sectors to the nut to cause the nut to hold the sectors radially expanded.

7. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with the sectors, a pair of disks engaging the opposite end faces of the sectors and freely rotatable upon the shaft, at least one of said disks having tongue and groove connections with the sectors to guide the sectors radially, means engageable with the disks to prevent the assembly of disks and sectors from moving axially of the shaft, and a nut threaded on the shaft, said nut and said sectors having complementally beveled engaging surfaces arranged to wedge the sectors radially out from the axis of the shaft to grip the abrasive band internally upon relative axial movement of the nut and the sectors when the nut is turned on the shaft.

8. In a rotary abrading tool, an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft, means for holding the tool body against axial movement relative to the shaft, a nut threaded on the shaft, said nut and said tool body having complementally beveled engaging surfaces arranged to cause the tool body to be expanded by wedging action of the nut when the nut is turned on the shaft while the tool body is held against axial movement relative to the shaft, a stop screw threaded through the nut parallel to the shaft for adjustably limiting the travel of the nut along the shaft and therefore the expansion of the tool body, and an abutment for the stop screw held against axial movement relatively to the shaft.

9. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with the sectors, a nut threaded on said shaft and having a periphery in the form of a frustum of a pyramid, each of said sectors having an inner face complemental to and slidable upon one of the frusto-pyramidal faces of the nut, means for holding the sectors against axial movement relatively to the shaft, and means for preventing relative rotation between the sectors and the nut about the axis of the shaft, whereby the turning of the tool body about the shaft causes the nut to turn about the shaft and therefore travel axially to expand the tool body by the wedging action of the frusto-pyramidal faces against the sectors.

10. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of abrasive sheet material, means for limiting the expansion of the tool body, a pair of end disks coaxial with the sectors and between which the sectors are interposed, a nut adapted to be threaded on a shaft and having a periphery adapted to expand the tool body by wedging action against the sectors when the nut is moved

axially with respect to the sectors, each sector having an inner face engaging the periphery of the nut and adapted to cooperate therewith in such wedging action, and means for rigidly connecting said disks to each other to form a unitary assembly while permitting axial movement of the nut between the disks.

11. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body having a periphery adapted to carry an endless band of sheet material, a pair of end disks coaxial with the sectors and between which the sectors are interposed, a plurality of spacing sleeves parallel to the axis of the tool body interposed between the end disks to hold the end disks spaced apart, a clamping screw extending through each sleeve having an end portion threaded into one of the disks and a head engaging the other disk for clamping the disks against the ends of the sleeves to form the disks and sleeves into a unitary assembly, a nut adapted to be threaded on a shaft and having a periphery in the form of a frustum of a pyramid, said nut having also holes which slidably engage the sleeves to enable the nut to move axially with respect thereto, each sector having an inner face complemental to one of the frusto-pyramidal faces of the nut, and interlocking keyed connections between the sectors and the nut for enabling relative sliding movement to take place in the directions of elements of said pyramid, whereby axial movement of the nut relatively to the tool body will wedge the sectors out to expand the tool body.

12. In a rotary abrading tool, a plurality of sectors arranged to form an expansible tool body

having a periphery adapted to carry an endless band of abrasive sheet material, a rotary shaft coaxial with said sectors, a nut threaded on said shaft adjacent to one end of the tool body formed by the sectors, said nut and said sectors being constructed and arranged to cause the nut to wedge the sectors outwardly from their common axis to grip the abrasive band internally upon relative axial movement between the nut and the sectors, a wedge freely slidable and rotatable on said shaft adjacent to the other end of the tool body formed by said sectors, a rigid connection between said nut and said wedge whereby axial movement of the nut causes axial movement of the wedge, said wedge and said sectors being constructed and arranged to cause the wedge to wedge the sectors outwardly upon relative axial movement between the wedge and the sectors, and means for holding the sectors against axial movement while the nut is being turned on the shaft to cause the nut and the wedge to expand the sectors radially.

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