

Sept. 6, 1966

A. BLOCK ET AL

3,270,467

ABRASIVE DEVICE

Filed July 1, 1963

2 Sheets-Sheet 1

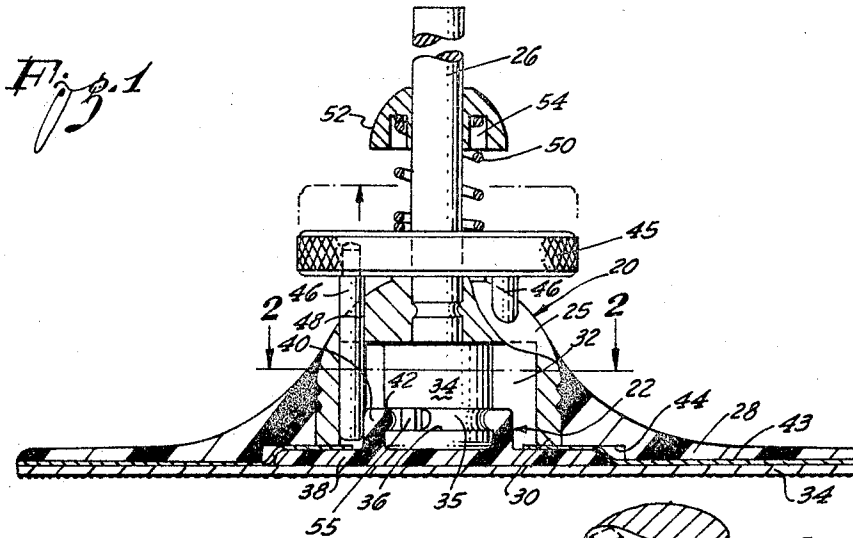


Fig. 2

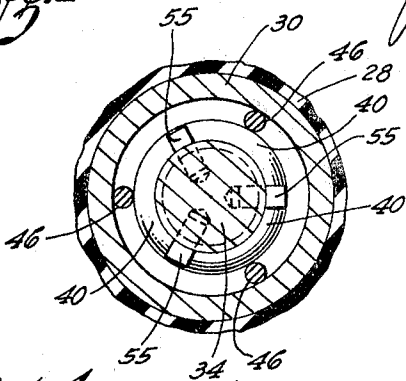


Fig. 3

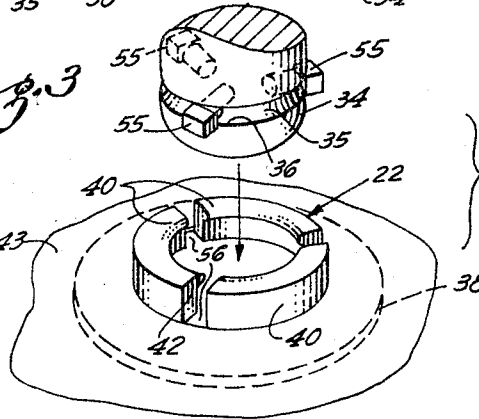


Fig. 4

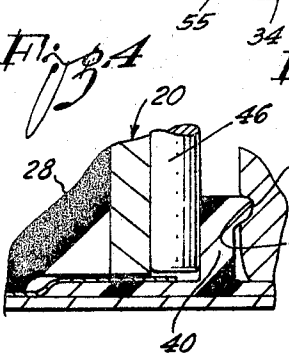


Fig. 5

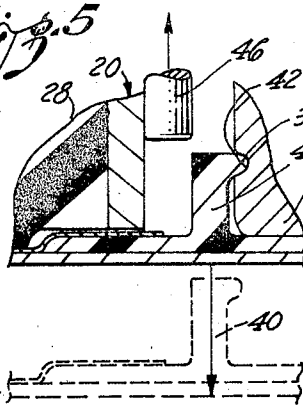
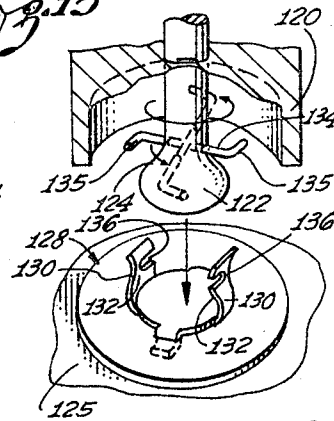


Fig. 15



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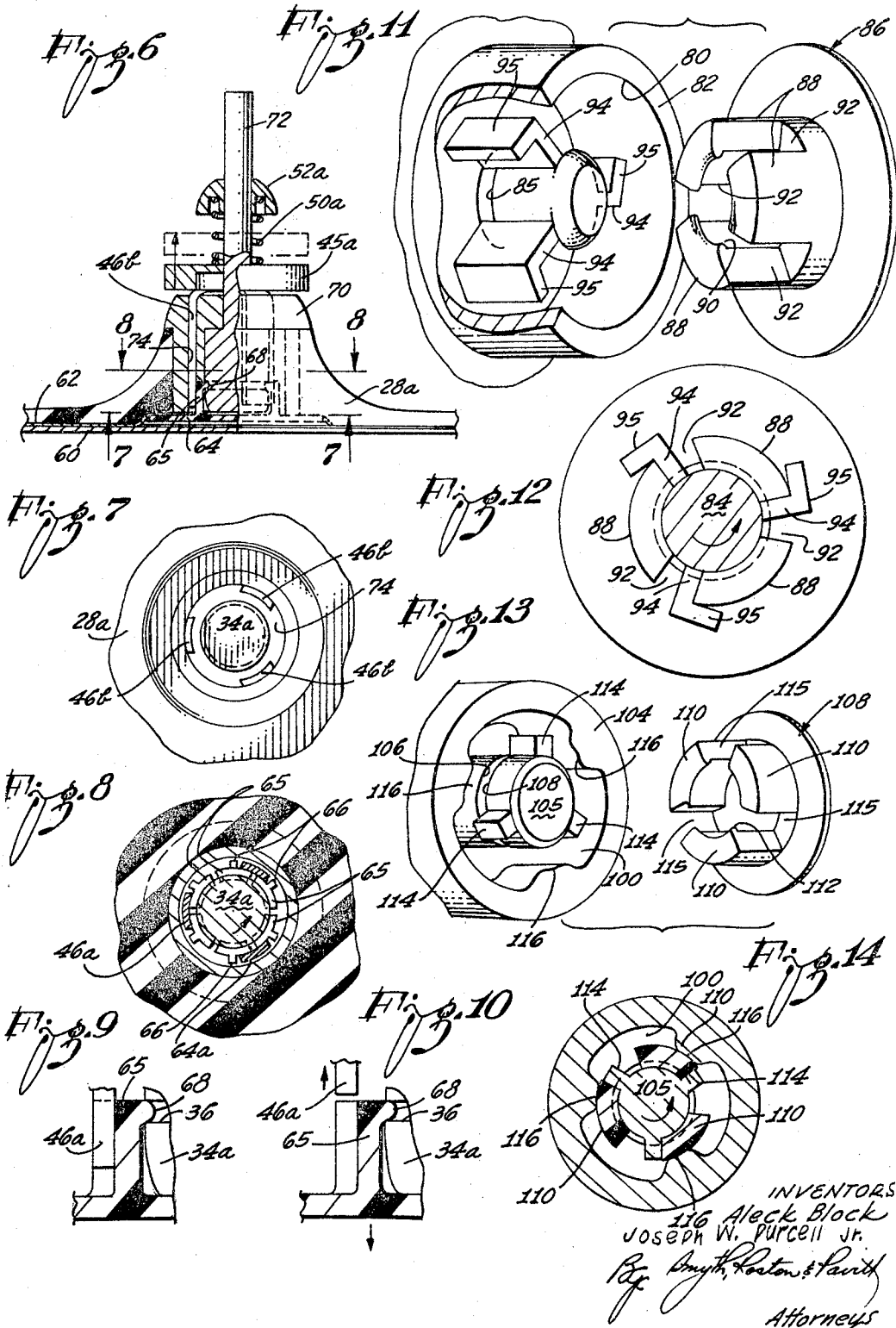
A. BLOCK ET AL

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ABRASIVE DEVICE

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2 Sheets-Sheet 2



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3,270,467

ABRASIVE DEVICE

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16 Claims. (Cl. 51—358)

This invention relates to an abrasive apparatus having a power-actuated rotary drive member on which replaceable abrasive disks are mounted for processing workpieces. The replaceable abrasive disks are commonly fabric disks coated with abrasive particles and backed up or reinforced by a flexible elastomeric member.

For the purpose of minimizing the cost of performing abrading operations with such an apparatus, it is essential that the procedure of replacing an abrasive disk be quickly and easily performed, since the disks are short-lived and must be replaced frequently. In addition, economy requires that the disposable disks themselves be of inexpensive construction. In a typical apparatus, the flexible elastomeric member that backs up the abrasive disk is permanently attached to the rotary drive member of the apparatus, so that the disposable unit comprises simply the abrasive disk and some means for releasably anchoring the abrasive disk in position against the flexible elastomeric member.

It is apparent that two cooperating means must be provided on the drive member and on the abrasive disk, respectively, for interlocking with each other quickly and efficiently. The releasable interlocking engagement must serve the two functions of locking the abrasive disk against rotation relative to the drive member and of anchoring the abrasive disk against axial separation from the drive member.

The present invention meets the problem of releasably mounting an abrasive disk on a rotary drive member by providing an annular socket on the drive member and by providing the abrasive disk with a suitable hub structure to fit into the annular socket. The annular socket has two radially spaced circumferential walls, the inner wall forming what may be termed an axial boss of circular configuration having an axially inwardly directed peripheral shoulder. The hub structure that carries the abrasive disk and fits into the annular socket has radially inwardly directed shoulder means to releasably engage the peripheral shoulder of the axial boss, and the hub structure is suitably resilient for the required releasable engagement. With the flexible hub structure suitably biased for such engagement, the hub structure may be moved into engagement with the boss with a snap action.

It is desirable to provide suitable locking means on the drive member to hold the flexible hub structure tightly against the axial boss to lock the hub structure in its engaged position. As will be explained, in some practices of the invention, the locking means is in the form of axial retractable means. In other practices of the invention, the locking means for confining the flexible hub structure against the axial boss comprises means which may be rotated relative to the drive member between a release position and a locking position.

With the described provision for interlocking the abrasive disk with the rotary drive member to prevent axial separation of the disk from the drive member, there remains the further requirement of interlocking the disk against relative rotation so that the disk will be actuated by the drive member. In the various practices of the invention, the flexible hub structure is divided into flexible segments with radial spaces between the successive segments. Some of the practices of the invention take advantage of this fact by providing the axial boss with ra-

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dial projections that extend into the radial spaces in engagement with the flexible segments to lock the abrasive disk against rotation relative to the drive member. In one practice of the invention, where retractable means is employed to lock the hub structure in axial engagement with the circular boss, the same retractable means meshes with the flexible segments of the hub structure to drive the abrasive disk.

The various constructions make it a simple matter to mount an abrasive disk on the rotary drive member. The hub structure of the abrasive disk is first inserted into the annular socket to engage the axial boss with a snap action, and then the abrasive disk is locked against axial withdrawal either by manipulating an axial retractable locking means or by rotating the abrasive disk to a locking position. To remove an abrasive disk that is worn out, the abrasive disk is first unlocked and is then simply pulled free from the annular socket.

The various features and advantages of the invention may be understood from the following detailed description and the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

FIG. 1 is a view largely in section and partly in side elevation illustrating a first embodiment of the invention, which employs retractable means to lock the hub structure of the disk in the annular socket of the drive member;

FIG. 2 is a fragmentary section taken along the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary perspective view showing the hub structure of the abrasive disk poised for axial movement into engagement with the axial boss and with the radial projections thereon;

FIG. 4 is a fragmentary sectional view on an enlarged scale showing how the axial retractable member locks a flexible hub segment in engagement with the axial boss;

FIG. 5 is a similar view showing the retractable means retracted to its release position;

FIG. 6 is a view partly in section and partly in side elevation illustrating a second embodiment of the invention employing retractable locking means, the view showing an abrasive disk mounted on the rotary drive member;

FIG. 7 is a fragmentary view as seen along the line 7—7 of FIG. 6, showing the annular socket of the rotary drive member with the abrasive disk removed;

FIG. 8 is a fragmentary section along the line 8—8 of FIG. 6, showing how the axially retractable means confines the flexible segments of the hub structure against the periphery of the axial boss;

FIG. 9 is an enlarged fragmentary view showing how an element of the axially retractable means confines a flexible segment of the hub structure;

FIG. 10 is a view similar to FIG. 9 showing the retractable means retracted to free the hub structure;

FIG. 11 is a fragmentary perspective view partly broken away, illustrating a third embodiment of the invention, the view showing the hub structure of a disk poised to enter the complementary annular socket of the rotary drive member;

FIG. 12 is a sectional view showing the hub structure of FIG. 11 engaged with the annular socket structure in a manner that locks the hub structure against both relative rotation and axial withdrawal;

FIG. 13 is a view similar to FIG. 11 illustrating a fourth embodiment of the invention, with the hub structure of an abrasive disk poised to enter the annular socket of a drive member;

FIG. 14 is a view similar to FIG. 12 showing the parts of FIG. 13 in mutual engagement; and

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FIG. 15 is a fragmentary perspective view illustrating still another embodiment of the invention.

FIG. 1, illustrating the first embodiment of the invention, shows a first structure, generally designated 20, that is adapted to be mounted on a rotary drive member (not shown) and shows a second hub structure, generally designated 22, which is unitary with an abrasive disk 24 and is adapted for releasable engagement with the first structure to mount the abrasive disk on the drive member in a quickly releasable manner.

The first structure 20 includes a circular body 25 mounted on a suitable shank 26, which shank may be engaged by a suitable chuck or collet (not shown) of a rotary drive member. The circular body 25 carries a tapered flexible flange 28 of elastomeric material which serves as a backing for the abrasive disk 24 when the abrasive disk is in service. The circular body 25 further provides a circular wall 30 which is the outer wall of an annular socket 32. The inner wall of the socket is the periphery of an axial boss 34 that is integral with the shank 26. The boss 34 is provided with a circumferential groove 35 which forms an axially inwardly directed shoulder 36 for releasable engagement by the hub structure 22.

As best shown in FIG. 1, the hub structure 22 may be in the form of a disk 38 with three circularly curved concentric segments 40 integral therewith. The disk is made of a suitable plastic material, such as nylon, by virtue of which the three segments 40 have a certain requisite degree of resilient flexibility. The three segments 40 are formed with radially inward flanges or lips 42 which serve as shoulder means for releasable engagement with the peripheral shoulder 36 of the boss 34. The three segments 40 are shaped and dimensioned to embrace the boss 34 snugly in the manner shown in FIG. 1 so that, by virtue of the resiliency of the segments, the hub structure may be snapped onto the boss 34 into engagement with the peripheral shoulder 36 of the boss.

As may be seen in FIG. 1, the abrasive-coated fabric layer of the abrasive disk 24 is reinforced by a fiberboard layer 43, and the plastic disk 38 of the hub structure is interposed between the fabric and the fiberboard to result in a stepped cross-sectional configuration. Accordingly, the first structure 20 that receives the hub structure 22 is countersunk to form a circular recess 44 around the rim of the annular socket cavity 32. The hub structure 22 of the plastic disk fits snugly against the inner surface of this circular recess.

Suitable means is provided to lock the three segments 40 of the hub structure in engagement with the peripheral shoulder 36 of the boss 34 when the hub structure is snapped into engagement with the boss. In this first embodiment of the invention, the locking means comprises a knurled ring 45 with three parallel locking pins 46 extending from the knurled ring in positions to engage the outer surfaces of the three resilient segments 40 respectively. FIGS. 1 and 4 show how the locking pins 46 in their effective positions confine the resilient segments 40 with the flanges 42 of the segments in positive engagement with the peripheral shoulder 36 of the boss 34. FIG. 5 shows how the locking pins 46 may be retracted to free the resilient segments 40 for release from the boss.

As shown in FIG. 1, the knurled ring 45 surrounds the shank 26, and the three locking pins 46 slidably extend through corresponding bores 48 in the circular body 25. To bias the knurled locking ring 45 towards its effective position, a suitable coil spring 50 is mounted in compression between the locking ring and a collar 52 that is fixedly mounted on the shank 26, the collar having an annular recess 54 to seat the upper end of the spring.

Suitable additional means is required to lock the abrasive disk against rotation relative to the power-driven rotary member on which it is mounted. In this first embodiment of the invention, this purpose is served by three radial lugs 55 on the boss 34, as best shown in

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FIG. 3, the three lugs being dimensioned and located to enter the three radial spaces 56 formed by the three resilient segments 40. Thus, when the abrasive disk is mounted on the boss 34 by snap engagement with the peripheral shoulder 36 of the boss, the three lugs 55, in effect, mesh with the three resilient segments 40 to drive the abrasive disk.

The task of mounting an abrasive disk in the manner indicated is quite simple. With the hub structure 22 of the abrasive disk correctly oriented relative to the three lugs 55 on the boss 34, as shown in FIG. 3, the knurled locking ring 45 is retracted to withdraw the locking pins 46. The hub structure is then inserted into the annular socket 32 to make snap engagement with the peripheral shoulder 36 of the boss 34, and then the locking ring 45 is released to be returned to its normal locking position by the coil spring 50. With the locking pins 46 in their effective positions, the hub structure is in positive engagement with the circular boss 34.

In the second embodiment of the invention shown in FIGS. 6 to 10, the abrasive disk is similar in structure to the abrasive disk employed in the first embodiment of the invention, the abrasive disk having an outer abrasive-coated fabric layer 60, an inner fiberboard layer 62, and a plastic hub structure comprising a plastic disk 64 within a plurality of resilient segments 65 integral therewith. In this instance, as shown in FIG. 8, there are six of the segments 65, each of which is formed with a longitudinal external rib 66. As best shown in FIGS. 9 and 10, each of the segments 65 is formed with a radially inward flange or lip 68 for releasable engagement with the previously mentioned peripheral shoulder 36 of a boss 34a.

As shown in FIG. 6, the structure that is adapted for mounting on a rotary drive member includes a circular body 70 mounted on a shank 72 and forming an annular socket 74 around the boss to receive the six segments 65 of the hub structure. United with the circular body 70 is the usual flexible elastomeric flange 28a.

A knurled locking ring 45a character heretofore described is normally held in its effective position by the usual coil spring 50a backed against a collar 52a on the shank 72. The locking ring 45a carries three parallel flat locking fingers 46b which correspond to the locking pins 46 of the first embodiment of the invention.

In the normal advanced position of the locking ring 45a, the three locking fingers 46b are in the position shown in FIG. 8, where it can be seen that each of the locking fingers overlaps two of the segments 65 and is flanked by the two ribs 66 of the two segments. Thus, the locking pins 46a not only lock the resilient segments 65 against the periphery of the boss 34a, but also engage the ribs 66 to lock the abrasive disk against rotation relative to the drive member on which it is mounted.

FIG. 9 shows a locking finger 46a in its normal effective position, and FIG. 10 shows the locking finger withdrawn to free the hub structure for disengagement from the boss 34a. It is apparent that, in this second embodiment of the invention, the abrasive disk is releasably mounted on the rotary drive structure in the same general manner as in the first embodiment of the invention. In this second instance, however, the locking pins 46a serve both of the purposes of locking the abrasive disk against axial separation and of locking the abrasive disk against relative rotation.

In the third embodiment of the invention, shown in FIGS. 11 and 12, the first structure for permanent mounting on a rotary drive member provides an annular socket 80 formed by a circumferential wall 82 and an axial boss 84, the boss being cut away near its base to provide an axially inwardly facing peripheral shoulder 85. The hub structure, generally designated 86, that is mounted on the usual abrasive disk (not shown) has three resiliently flexible segments 88, each of which has a radially inward lip or flange 90 to function as

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shoulder means for snap engagement with the peripheral shoulder 85 of the boss 84.

The three segments 88 are separated by relatively wide radial gaps 92, and the boss 84 is provided with three corresponding radial projections 94 which extend through the gaps and which are substantially narrower than the gaps to permit a slight range of relative movement between the hub structure and the boss. Each of the three radial projections 94 is of angular configuration, being formed with an outer flange 95, as shown in FIG. 12.

In FIG. 12, the three radial projections 94 are in what may be termed their locking positions. At their locking positions, the three radial projections 94 abut edges of the three segments 88 respectively for rotation of the abrasive disk by the drive member, and at the same time the outer flanges 95 of the projections engage corresponding portions of the three segments with something of a wedging action to hold the three segments against the boss 84 in a positive manner. Thus, the outer flanges 95 of the radial projections 94 lock the resilient segments 88 in positive engagement with the boss 84.

When this third embodiment of the invention is in service, an abrasive disk may be snapped into engagement with the boss 84 in the usual manner, with the three segments 88 slightly rotated out of their locking positions relative to the three radial projections 94. After the hub structure is snapped into engagement with the boss in this manner, the hub structure is rotated to place the segments 88 in their locking positions against the radial projections, as shown in FIG. 12.

In the embodiment of the invention shown in FIG. 13, a socket cavity 100 to receive the hub structure 102 is formed by a circumferential wall 104 and an axial boss 105, the axial boss being provided with a circumferential groove 106 to form the usual peripheral shoulder 108. The hub structure 102 has three integral resilient segments 110 of the usual character, each of which is formed with an inner flange or lip 112 to serve as shoulder means for releasable engagement with the peripheral shoulder 108 of the boss.

The axial boss 105 is provided with three radial projections or lugs 114 positioned to extend into the three radial gaps 115 that separate the three segments. Here again, the three gaps 115 are substantially wider than the thickness of the radial lugs 114 to permit a certain range of relative rotation between the hub structure and the boss. For the purpose of locking the three resilient segments 110 against the axial boss 105, the circumferential wall 104 of the socket is formed with three inward projections or lobes 116.

The three lobes 116 are so positioned relative to the three lugs 114 that when the resilient segments 110 are rotated in one direction against the three lugs, the three inwardly projecting lobes 116 confine the flexible segments against the boss as shown in FIG. 14. But when the segments 110 are rotated to their opposite limit positions (not shown) relative to the three lugs 114, the three segments may be withdrawn from the socket 100 or may be inserted into the socket to make snap engagement with the peripheral shoulder 108 of the boss. It is to be understood, of course, that the three resilient segments 110 are held in their locked positions against the three lugs 114 by the resistance to rotation on the part of the abrasive disk.

In the last embodiment of the invention, illustrated by FIG. 15, the socket on the rotary drive member is formed by a cylindrical circumferential wall 120 and an axial boss 122, the boss being of bulbous configuration to provide an axially inwardly facing peripheral shoulder 124.

The abrasive disk 125 indicated in FIG. 15 has a hub structure 128 which provides a pair of diametrically opposite segments in the form of leaf spring fingers 130, which fingers are curved to form inner shoulders 132 for

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snap engagement with the peripheral shoulder 124 of the boss 122. The boss 122 is provided with a pair of diametrically opposite projections 134 in the form of angular pins, i.e., pins with outer bent ends 135. The two leaf spring fingers 130 are formed with oppositely directed notches 136 with which the pins 134 may be engaged by relative rotation between the hub assembly and the boss.

In this last embodiment of the invention, it is a simple matter to insert the leaf spring fingers 130 into the socket and into snap engagement with the boss 122 and then to rotate the abrasive disk to bring the two notches 136 into engagement with the two pins 134. It is to be noted that the engagement of the pins 134 with the notches 136 not only interlocks the hub structure with the boss for rotation of the abrasive disk, but also locks the abrasive disk against axial separation from the boss. It is also to be noted that the pins 134 are held in the notches 136 by the resistance to rotation on the part of the abrasive disk and that the bent ends 135 of the pins serve as locking means and keep the leaf spring fingers 130 from spreading in response to centrifugal force.

The description in specific detail of the selected embodiments of the invention will suggest various changes, substitutions, and other departures from our disclosure within the spirit and scope of the appended claims.

We claim:

1. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

structure on said drive member forming a socket with two radially spaced circumferential walls, the inner wall of the socket being formed with a peripheral shoulder facing axially inward;

a radially flexible hub structure united with said abrasive disk and dimensioned to enter said socket, said hub structure being formed with radially inward shoulder means and being biased for engagement of said shoulder means with said peripheral shoulder to resist axial separation of the two structures;

means on said socket structure to releasably confine said flexible hub structure against said inner wall to lock said shoulder means in engagement with said peripheral shoulder; and

cooperative means on the two structures respectively for mutual abutment to cause said hub structure to rotate with the socket structure, said cooperative means including radial gaps at spaced positions in an annular direction on the shoulder means and radial members on the structure on the drive member, said radial structure extending through the radial gaps.

2. A combination as set forth in claim 1, in which said confining means is retractable axially of the socket structure to release said hub structure.

3. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

a first structure on the drive member forming an axial boss with an inwardly facing peripheral shoulder; and

a second flexible structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures,

said second structure being divided into flexible segments separated by radial spaces, each of said segments being separated from the adjacent segments to form a radial shoulder; and

means on said first structure and extending into the separations between the segments to engage said radial shoulders of the segments to prevent relative rotation between the two structures and to confine the segments against the boss to interlock the shoulder means on the segments with the peripheral shoulder of the boss.

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4. A combination as set forth in claim 3, in which said last-mentioned means includes radial projections on the boss positioned to extend into the separations between the adjacent pairs of segments.

5. A combination as set forth in claim 4, in which the radial projections have angular end portions to confine the segments.

6. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the drive member forming an axial boss with an inwardly facing peripheral shoulder;
- a second flexible structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures, said second structure being divided into flexible segments separated by radial spaces;
- radial projections on said boss positioned to extend into the radial spaces in abutment with the segments to prevent relative rotation between the two structures; and

means on said first structure to releasably confine said segments against said boss to interlock said shoulder means with said peripheral shoulder.

7. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the drive member forming an axial boss with an axially inwardly facing peripheral shoulder;
- a second flexible structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures,
- said second structure being divided into flexible segments separated by radial spaces,
- each of said segments being formed with a radial outward shoulder; and
- means on said first structure to extend retractably through said radial spaces into engagement with the outer surfaces of said segments to confine the segments against the boss to interlock the shoulder means with the peripheral shoulder, said retractable means being positioned to engage said radial shoulders of the segments to interlock the two structures against relative rotation.

8. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the drive member forming an axial boss with an inwardly facing peripheral shoulder;
- a second flexible structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures,
- said annular hub structure being divided into flexible segments separated by radial spaces,
- radial projections on said boss positioned to extend into said radial spaces in engagement with said segments to interlock the two structures against relative movement; and
- a circumferential wall on said first structure spaced radially outward from said boss to surround said segments when the segments are in engagement with the boss, said peripheral wall having radially inward projections to releasably engage the outer surfaces of the segments to hold the segments against the boss to interlock the shoulder means of the segments with the peripheral shoulder of the boss.

9. A combination as set forth in claim 8, in which said second structure is rotatable relative to the first structure between a release position at which the segments are out of register with said inward projections and a locking position at which the segments are in register with the inward projections.

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10. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the drive member forming an axial boss with an inwardly facing peripheral shoulder;
- a second flexible structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures, said hub structure being divided into flexible segments separated by radial spaces;
- means carried by said first structure positioned to extend into said radial spaces in abutment with said segments to prevent relative rotation between the two structures; and

means on said first structure retractably movable axially of the first structure into positions abutting the outer surfaces of the segments to confine the segments against the boss to lock said shoulder means of the segments in engagement with the peripheral shoulder of the boss.

11. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the rotary drive member forming a boss with an inwardly directed peripheral shoulder;
- a hub structure united with the abrasive disk and providing flexible fingers to releasably embrace said boss in engagement with the peripheral shoulder, said fingers being formed with notches facing in a given circumferential direction; and
- a plurality of means projecting radially from said boss to engage said fingers to interlock the two structures against relative rotation and to engage said notches to resist axial separation between the two members.

12. A combination as set forth in claim 11, in which said radial projecting means have angular end portions to hold the fingers against the boss when the radially projecting means engage the notches of the fingers.

13. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the drive member forming an axial boss with an inwardly facing peripheral shoulder;
- a second flexible hub structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures, said hub structure being divided into flexible segments separated by radial spaces;

means on said first structure to releasably confine said segments of the hub structure against said boss to lock the segments in engagement with said peripheral shoulder; and

means to interlock the two structures against relative rotation to cause the first structure to rotate the abrasive disk, said interlocking means comprising radial projections on said hub structure and positioned to extend through said radial spaces in abutment with said segments.

14. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

- a first structure on the drive member forming an axial boss with an inwardly facing peripheral shoulder;
- a second flexible hub structure united with the abrasive disk to releasably embrace said boss in engagement with said peripheral shoulder to resist axial separation of the two structures, said hub structure being divided into flexible segments separated by radial spaces;

means on said first structure to releasably confine said segments of the hub structure against said boss to lock the segments in engagement with said peripheral shoulder; and

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means to interlock the two structures against relative rotation to cause the first structure to rotate the abrasive disk, said interlocking means comprising axially retractable means on the first structure to engage said segments.

15. In an apparatus of the character described, means for mounting an abrasive disc member on a rotary drive member, comprising:

a first structure adapted to be mounted on said drive member, said first structure including a boss with an axially inwardly facing peripheral shoulder;

a second structure adapted to be united with the abrasive disc to enclose said boss and releasably engage said peripheral shoulder to resist axial separation of the two structures, said hub structure being formed with a plurality of annularly disposed segments annularly separated from one another by gaps; and

means on said first structure positioned radially of said boss and extending through the gaps between adjacent pairs of annularly disposed segments to engage said second structure to cause the second structure to rotate with the first structure.

16. In an apparatus of the character described, means for mounting an abrasive disk member on a rotary drive member, comprising:

a first structure adapted to be mounted on said drive member, said first structure including a boss with an axially inwardly facing peripheral shoulder;

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a second structure adapted to be united with the abrasive disk to embrace the boss, said second structure being resilient and being formed with radially inward shoulder means to engage said peripheral shoulder with snap action to resist axial separation of the two structures;

means on said first structure to releasably confine said second structure against said boss to lock said shoulder means in engagement with said peripheral shoulder; and

cooperative means on the two structures, respectively, for mutual abutment to cause said second structure to rotate with the first structure, said cooperative means including segments annularly disposed on one of the structures and separated by radial gaps and means disposed on the other structure and extending into the radial gaps.

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LESTER M. SWINGLE, *Examiner*.

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