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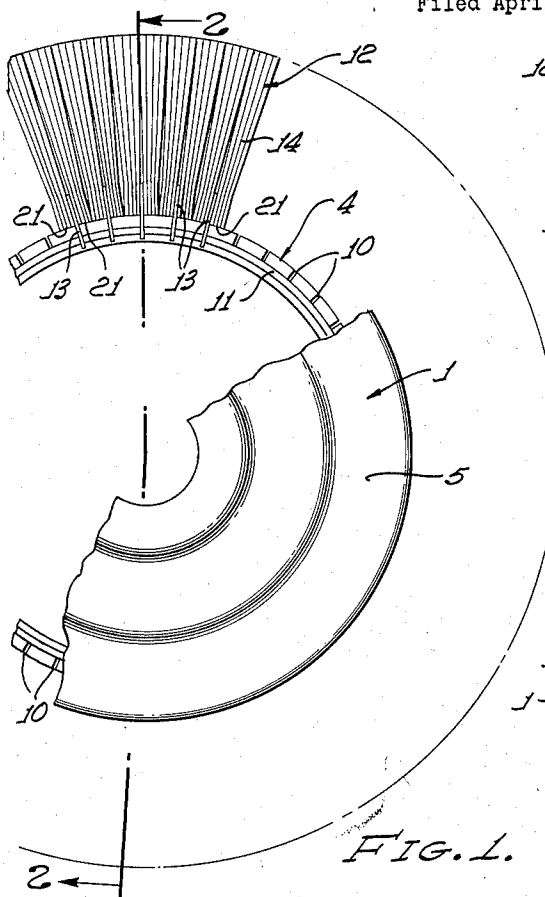


FIG. 1.

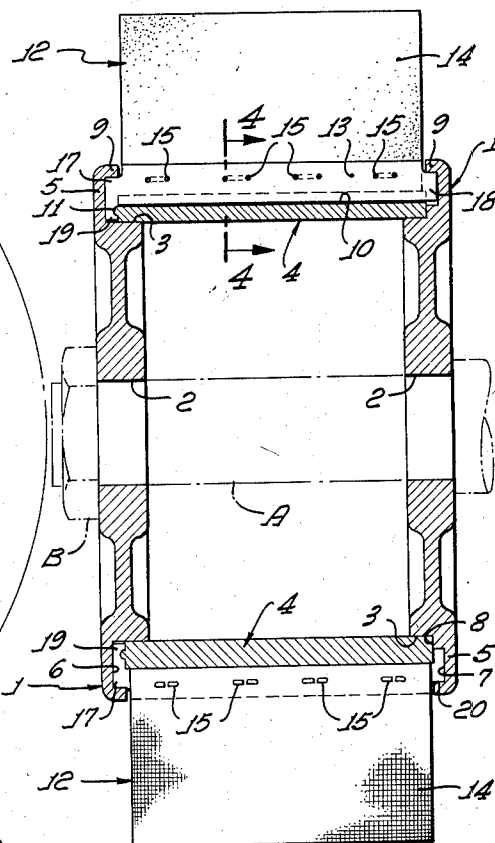


FIG. 2.

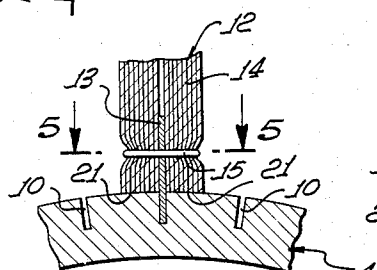


FIG. 4.

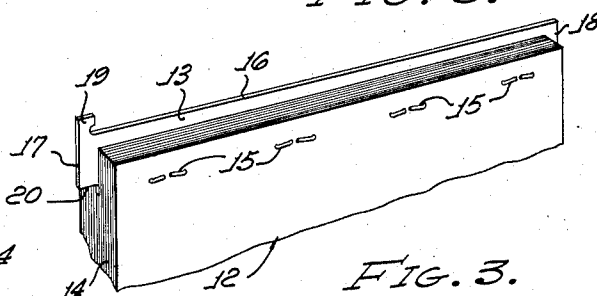


FIG. 3.

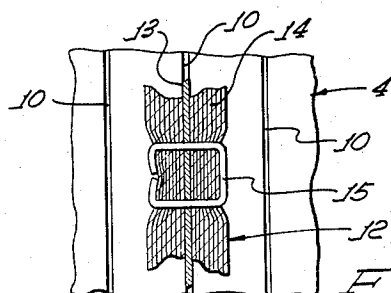


FIG. 5.

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ABRASIVE WHEEL AND REPLACEABLE ABRASIVE UNIT THEREFOR

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This invention relates to abrasive wheels and replaceable abrasive units therefor, and included in the objects of this invention are:

First, to provide an abrasive wheel wherein a plurality of abrasive units, each comprising a multiplicity of abrasive radiating sheets secured to a reinforcing plate, are mounted on a hub structure, and wherein means are provided to secure the abrasive units in place by engagement with said reinforcing plates, so that the abrasive wheel may be safely rotated at high speed.

Second, to provide an abrasive wheel, including replaceable abrasive units, which is so arranged that the abrasive units may be readily and quickly removed when worn and new abrasive units substituted, all without the use of special tools.

Third, to provide an abrasive wheel with replaceable abrasive units which incorporates special means to aid in initial retention of the units during assembly and which cannot be assembled except in the correct manner, so that assembly or replacement may be made by unskilled or untrained persons without danger of malfunctioning of the abrasive wheel.

Fourth, to provide a replaceable abrasive unit wherein a stack of abrasive-coated sheets are compressed adjacent one margin to impress and embed the irregularities of each sheet into the adjacent sheets, and are tightly secured in such compressed condition to a metal anchor plate by staples or other fastening means so that the sheets are bound tightly to each other and to the plate, to resist removal of any of the sheets; and wherein the abrasive unit forms abutment shoulders on opposite sides of the anchor plate for engagement with a mounting hub to aid the plate in resisting lateral loads imposed on the abrasive unit.

Fifth, to provide a replaceable, multiple sheet, abrasive unit having an anchor plate, the ends of which protrude from the radially inner side of the unit as well as axially therefrom so as to be restrained against radial displacement by an overlying retaining ring engaging each axially protruding end of the plate, and be restrained against buckling or lateral forces by hub slots engaging the radially inner protruding margin of the plate.

Sixth, to provide an abrasive wheel wherein a series of abrasive units, each of which is essentially wedge-shaped in cross section by reason of being compressed along one margin, are fitted endwise on a hub structure in closely adjacent relation with each other, so that the abrasive units mutually support each other against tangential loads, as imposed when the extremities of the abrasive units are engaged by a workpiece.

With the above and other objects in view as may appear hereinafter, reference is directed to the accompanying drawings in which:

Figure 1 is a fragmentary end view of the abrasive wheel with a view of the abrasive units shown in position thereon;

Fig. 2 is a sectional view thereof through 2-2 of Fig. 1;

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Fig. 3 is a fragmentary perspective view showing the secured end of an abrasive unit;

Fig. 4 is an enlarged fragmentary sectional view through 4-4 of Fig. 2;

Fig. 5 is a fragmentary sectional view through 5-5 of Fig. 4.

The abrasive wheel includes a pair of end plates 1, each having a central bore 2 for installation on a shaft, not shown. The confronting sides of the end plates 1 are provided with annular shoulders 3 which support the ends of a hub cylinder 4. The end plates project radially beyond the ends of the hub cylinder 4, forming flanges 5 having annular channels 6 and 7 which face toward the ends of the hub cylinder 4. The channel 6 extends radially inward to the corresponding shoulder 3, whereas the channel 7 terminates short of the shoulder to form a stop 8 which is engaged by the corresponding end of the hub cylinder 4. Formed at the radially outer margins of the channels 6 and 7 are retaining lips 9.

The hub cylinder 4 is provided externally with a plurality of axially directed narrow grooves or slits 10 extending the full length of the hub cylinder. One end of the hub cylinder 4 is provided with an annular axially directed rib 11 radially inward of the grooves or slits 10, which, as will be brought out hereinafter, facilitates the mounting of abrasive units on the hub structure. The inner margin of the channel 6 clears the end of the hub cylinder 4 having the annular rib 11.

The hub cylinder 4 supports a plurality of abrasive units 12. Each abrasive unit includes a metal anchor plate 13 to which is secured a stack of abrasive sheets 14. The abrasive sheets are compressed adjacent one margin so that the irregularities of each sheet are impressed into the adjacent sheets to effectively interlock the sheets together. The sheets are secured in such compressed condition by heavy duty staples 15 which extend laterally through the abrasive sheets and the anchor plate, as indicated in Figs. 4 and 5.

The abrasive sheets 14 may be formed of various abrasive sheet materials, such as cloth or paper, coated with abrasive. All of the sheets may be abrasive coated, or lubricant or spacer sheets may be interleaved. Also, the sheets may be initially free of abrasive. For example, cloth sheets, preferably cut to dispose the warp and woof on the bias, may be used. In such case, the abrasive, usually rouge or other fine abrasive or polishing material, is applied during the course of use of the wheel.

The abrasive sheets when stacked have a limited amount of compressibility so that when compressed adjacent one margin the stack is essentially wedge-shaped in cross section. The retentative force between the secured areas of the sheets is in excess of the tensional strength of the free sheet, so that irrespective of the loads imposed by rotation of the wheel and the application of workpieces to the surface of the wheel, the abrasive sheets are securely held.

Each anchor plate 13 protrudes from the secured margins of the abrasive sheets 14 to form a protruding rib 16, which also protrudes from the ends of the stack of sheets to form locking elements 17 and 18 which fit respectively in the channels 6 and 7 when the rib 16 is placed in one of the grooves or slits 10. The locking element 17 terminates in a hook 19 which is adapted to overlie the corresponding end of the hub cylinder 4 and engage the annular rib 11. As it is desired that the radially outer edges of the anchor plates 13 be substantially flush with the peripheries of the end plates 1, the radially outer corners of the anchor plates 13 may be provided with notches 20.

The abrasive units 12 are formed as follows:

A plurality of identically shaped sheets 14, with or with-

out abrasive, as desired, are placed on one or both sides of the metal anchor plate 13 in such a manner that the plate 13 is disposed adjacent one edge of the stack of sheets, with the rib 16 protruding from the stack and with its ends 17 and 18 also protruding. The stack is then compressed sufficiently to cause interlocking of the surfaces of the sheets due to the pressure of abrasive or the weave of the cloth. A plurality of the metal staples 15 is then driven through the entire unit, including the anchor plate 13, and clinched so as to secure the sheets in their compressed condition.

The staples 15 firmly bind the elements together to form a laminated pack of abrasive sheets, the elements of which are so compressed adjacent the staples 15 that they reinforce each other. In use, the abrasive unit 12 is so formed to resist bending and to resist the separation of any of the individual components from the pack. Each of the abrasive sheets 14 is thus provided with increased resistance to the centrifugal and other separating forces which it encounters in use.

The completed abrasive units 12 are assembled on the wheel as follows:

The end plate 1 having the channel 7 is preferably placed on a horizontal surface and the hub cylinder 4 fitted thereon with the slits 10 disposed vertically. The abrasive units 12 are then assembled by inserting the rib portions 16 of the anchor plates 13 into the slits 10 and moving the abrasive units axially until the locking elements 18 enter the channel 7. Simultaneously, the hook 9 is caused to engage the annular rib 11. The annular rib 11 and channel 7 cooperate to hold the abrasive units 12 in position pending installation of the remaining end plate 1. After assembly of the abrasive units, this end plate is positioned over the corresponding end of the hub cylinder 4 so that the channel 6 receives the locking elements 17. The assembled abrasive wheel is then mounted on a suitable drive shaft A, indicated by broken lines in Fig. 2, which is screw-threaded and provided with a nut B so that the end plates 1 and hub structure may be secured together.

While the abrasive wheel may be assembled with ease when its axis is vertical, it is nevertheless convenient, when the wheel is in use, to replace the abrasive units when the axis of the abrasive wheel is horizontal, that is, while mounted on its drive shaft. In this case, the end plate 1 bearing the channel 6 is slipped axially far enough to clear the locking elements 17. Worn abrasive units may then be removed by slipping them axially until the locking elements 18 clear the channel 7 and the hooks 19 are free of the rib 11, whereupon the abrasive units 12 may be removed radially. New units are inserted by fitting the ribs 16 into the slits 10 and slipping the anchor plates 13 axially to engage the locking elements 18 and hooks 19. The abrasive wheel may be turned as the assembly proceeds until all of the abrasive units 12 are in place; whereupon the end plates 1 are tightened axially.

It will be observed that the end plate 1 having the channel 6 bears axially against the locking elements 17 so that the abrasive units 12 are firmly held in place. The retaining lips 9 overlie the radially outer margins of the locking elements 17 and 18 so that the abrasive units are securely restrained against the centrifugal force produced on rotation of the abrasive wheel.

By reason of the fact that the grooves or slits 10 extends the full length of the anchor plates 13, the anchor plates cannot bend laterally. The radial depth of the anchor plates is such that the anchor plates readily withstand any tendency to bend lengthwise. Thus, the anchor plates, although formed of sheet metal, are so secured as to resist the relatively extreme forces which are applied when the abrasive wheel is rotated at high speed and workpieces are thrust against the abrasive sheets.

By reason of the compression afforded by the staples 15, the free ends of the abrasive sheets 14 tend to fan

out from each other so that when assembled on the hub cylinder 4 the free extremities of the sheets are substantially equally spaced.

It will be observed that the root end of the divided stack forms shoulders 21 on opposite sides of the anchor plates 13 which bear against the hub cylinder 4 and reinforce the anchor plate against bending at its line of emergence from the slot 10. The degree of reinforcement afforded by the tightly compressed stack of sheets is substantial.

When all of the abrasive units 12 are in place around the periphery of the hub structure, the surfaces of each abrasive unit 12 are disposed in bearing engagement with the surfaces of the abrasive units on each side. Each of the abrasive units 12 thus reinforces the others to strengthen the abrasive units 12 and sheets 14 against any bending or sideward movement at its root or secured end adjacent the periphery of the hub structure.

While a particular embodiment of this invention has been shown and described, it is not intended to limit the same to the exact details of the construction set forth, and it embraces such changes, modifications, and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

What is claimed is:

1. An abrasive wheel, comprising: a cylindrical hub having a plurality of continuous axially directed slots; end flanges for said hub including annular lips confronting the ends of said slots; a plurality of anchor plates, each positioned edgewise in a slot and restrained throughout its length against bending about an axis radial of said hub, the axial ends of each anchor plate extending between said hub and said annular lips and restrained by said lips against radial displacement; a stack of sheets compressed against each anchor plate; binding means penetrating each stack of sheets and the corresponding plate to secure said sheets in compressed condition relative to each other and said anchor plate; said stack of sheets forming a shoulder extending laterally of said anchor plate for bearing engagement with the surface of said hub to reinforce said anchor plate against bending about an axis parallel to said hub; each of said stack of sheets also being in abutting relation with adjacent stacks of sheets thereby to mutually support each other.

2. An abrasive wheel, comprising: a cylindrical hub having a plurality of continuous axially directed slots; a plurality of anchor plates, each adapted to be positioned edgewise in a slot and restrained throughout its length by said hub against bending about an axis radial of said hub; an annular lip disposed radially outwardly of one end of said hub; an annular rib disposed radially inwardly of the periphery of the hub at the other end thereof; each of said anchor plates having an axial projection at one end arranged to fit under said lip and a hook at its other end arranged to fit under said rib upon axial movement of said anchor plate relative to said hub, to restrain said anchor plates from radial displacement during assembly of said anchor plates on said hub; a second annular lip cooperating with the radially outer edge of the hook ends of said anchor plates to lock said plates relative to said hub; a stack of sheets compressed against each anchor plate; and means penetrating each stack of sheets and corresponding anchor plate to secure said sheets in compressed condition relative to each other and said anchor plate; said stack of sheets forming a shoulder extending laterally of said anchor plate for bearing engagement with the surface of said hub to reinforce said anchor plate against bending about an axis parallel to said hub.

3. An abrasive wheel, comprising: a cylindrical hub having a plurality of continuous axially directed slots; a plurality of anchor plates, each adapted to be positioned edgewise in a slot and restrained throughout its length by said hub against bending about an axis radial of said hub; means for retaining said anchor plates in said slots against radial displacement; a plurality of stacks of flexi-

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ble sheet members, each of said stacks being divided to straddle a corresponding anchor plate and extend radially therebeyond, said sheets having limited compressibility in a direction transverse to said stacks; a plurality of staples extending transversely through each stack and its anchor plate to secure said sheets in a compressed condition against each other and said anchor plate, thereby to resist radial displacement relative to each other and to said anchor plates; said stack of sheets forming a shoulder extending laterally of said plate for bearing engagement with the surface of said hub to reinforce said anchor plate against bending about an axis parallel to said hub.

4. An abrasive wheel, comprising: a cylindrical hub having a plurality of continuous axially directed slots; end flanges for said hub including annular lips confronting the ends of said slots; a plurality of anchor plates, each positioned edgewise in a slot and restrained throughout its length against bending about an axis radial of said hub, the axial ends of each anchor plate extending between said hub and said annular lips and restrained by said lips against radial displacement; a plurality of stacks of flexible sheet members, each of said stacks being divided to straddle a corresponding anchor plate and extend radially therebeyond, said sheets having limited compressibility in a direction transverse to said stacks; a plurality of staples extending transversely through each stack and its anchor plate, said staples securing said stacks in a compressed condition, thereby to restrain said sheets against radial displacement relative to each other and to said anchor plates; said stack of sheets forming a shoulder extending laterally of said plate for bearing engagement with the surface of said hub to reinforce said plate against bending about an axis parallel to said hub; each of said stacks of sheets also being disposed in abutting relation with adjacent stacks of sheets, whereby said stacks of sheets reinforce each other against bending or sideward movement in the region of said anchor plates.

5. An abrasive wheel, comprising: a cylindrical hub having a plurality of continuous axially directed slots; a plurality of anchor plates, each adapted to be positioned edgewise in a slot and restrained throughout its length by said hub against bending about an axis radial of said hub; an annular lip disposed radially outwardly of one end of said hub; an annular rib disposed radially inwardly of the periphery of the hub at the other end thereof; each of said anchor plates having an axial projection at one end arranged to fit under said annular lip and a hook at its other end arranged to fit under said rib upon axial movement of said plate relative to said hub, to restrain said anchor plates from radial displacement during assembly of said plates on said hub; a second annular lip cooperating with the radially outer edge of the hook ends of said plates to lock said anchor plates relative to said hub; said annular lips forming means for retaining said anchor plates in said slots against radial displacement; a plurality of stacks of flexible sheet members, each of said stacks being divided to straddle a corresponding anchor plate and extend radially therebeyond, said stack of sheets having limited compressibility in a direction transverse to said stacks; and a plurality of staples extending transversely through each stack and its anchor plate, said staples securing said stacks in a compressed condition thereby to restrain said sheets against radial displacement relative to each other and to said anchor plates; said stack of sheets forming a shoulder extending laterally of said plate for bearing engagement with the surface of said hub to reinforce said anchor plate against bending about an axis parallel to said hub.

6. A replaceable abrasive unit for cylindrical hub structures having axial slots and retaining means, comprising: an anchor plate; a stack of flexible sheet members, said stack being divided at one margin to straddle said anchor plate, said sheets having limited compressibility in a direction transverse to said stack; and a plurality of staples extending transversely through said stack and

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anchor plate, each staple securing said sheets in a compressed condition to lock said sheets in said stack and to said anchor plate; said anchor plate protruding from said stack to fit a slot of said hub structure and having means for engagement by said retaining means.

7. A replaceable abrasive unit for cylindrical hub structures having axial slots and retaining means confronting the extremities of said hub structures, comprising: an anchor plate; a stack of flexible sheet members, said stack being divided at one margin to straddle said plate, said stack of sheet members having limited compressibility in a direction transverse to said stack; and a plurality of staples extending transversely through said stack and anchor plate, each staple securing said sheet members in a compressed condition to lock said sheet members in said stack and to said anchor plate; said anchor plate protruding from an edge of said stack to fit a slot of said hub structure and protruding from the ends of said stack to engage said retaining means; said stacks of sheet members tending by reason of their compressed condition to assume a wedge shape whereby the stack of sheet members, when assembled on said hub structure, afford mutual support to reinforce said anchor plates; said stack of sheet members forming shoulders at their stapled ends extending laterally from their anchor plates for engagement with said hub structure thereby to further reinforce said anchor plates.

8. A replaceable abrasive unit for cylindrical hub structures having axial slots, a retaining rib at one axial end and flanges at both ends having retaining lips radially outward of the ends of the hub, said abrasive unit, comprising: an anchor plate; a stack of flexible sheet members, said stack being divided at one margin to straddle said anchor plate, said stack of sheet members having limited compressibility in a direction transverse to said stack; and a plurality of staples extending transversely through said stack and anchor plate, each staple securing said sheet members in a compressed condition to lock said sheet members in said stack and to said anchor plate; said anchor plate protruding from an edge of said stack to fit a slot in said hub structure and protruding from the ends of said stack between said hub and retaining lips; said plate also having a hook at one end engageable with said retaining rib.

9. A plurality of abrasive units arranged to be removably mounted around the periphery of a slotted hub structure having end-retaining flanges, each of said abrasive units comprising: an anchor plate adapted to be positioned edgewise in a slot in said hub with its ends extending under said retaining flanges; a stack of sheets compressed against each anchor plate; fastening means penetrating each stack of sheets and corresponding anchor plate to secure the margins of said sheets overlying said anchor plate in a relatively rigid and compressed condition relative to each other and said anchor plate the compressed and secured margins of said abrasive units forming lateral shoulders for bearing engagement with said hub to resist bending of said anchor plates; said abrasive units, when assembled on said hub structure, being disposed in abutting relation with each other whereby said abrasive units in addition to said shoulders mutually reinforce each other against bending or sideward movement in the region of said anchor plate.

10. A plurality of abrasive units arranged to be removably mounted around the periphery of a slotted hub structure having end-retaining flanges, said abrasive units comprising: a plurality of anchor plates, each adapted to be positioned edgewise in a slot and restrained thereby throughout its length by said hub structure against bending about an axis radial of said hub structure, and restrained at its ends against radial displacement by said retaining flanges; a plurality of stacks of flexible sheet members, each of said stacks being divided to straddle a corresponding anchor plate and extend radially there-

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beyond, said sheets having limited compressibility in a direction transverse to said stacks; a plurality of staples extending transversely through each stack and its anchor plate to secure said sheets in a compressed condition against each other and said anchor plate, thereby to resist radial displacement relative to each other and to said anchor plates; said stack of sheets forming a shoulder extending laterally of said plate for bearing engagement with the surface of said hub to reinforce said anchor plate against bending about an axis parallel to said hub.

11. A replaceable abrasive unit for cylindrical hub structures having axial slots and retaining means, comprising: an anchor plate; a stack of flexible sheet members, said sheets having limited compressibility in a direction transverse to said stack, said stack disposed on at

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least one side of said anchor plate to form a lateral shoulder; a plurality of clamping and fastening means penetrating said stack and plate and compressing said stack to impart increased rigidity in the region of said shoulder whereby when assembled on said drum with said anchor plate within a slot thereof, said anchor plate is reinforced against bending about an axis parallel to said hub axis, said anchor plate protruding axially from said stack for engagement by said retaining means.

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