Aug. 20, 1974 J. A. BELANGER Re. 28,118

FINISHING WHEELS

Original Filed Sept. 7, 1965 2 Sheets-Sheet 1

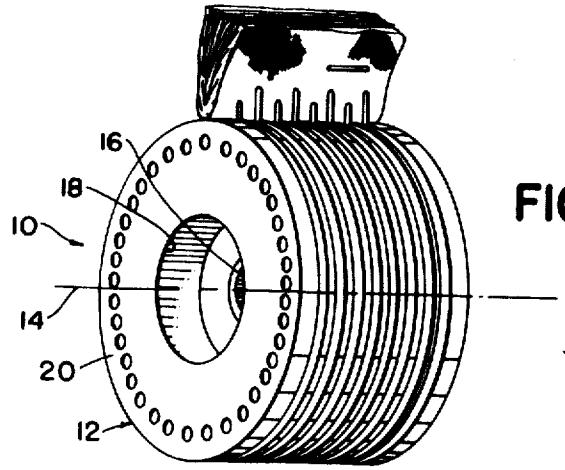


FIG. 1

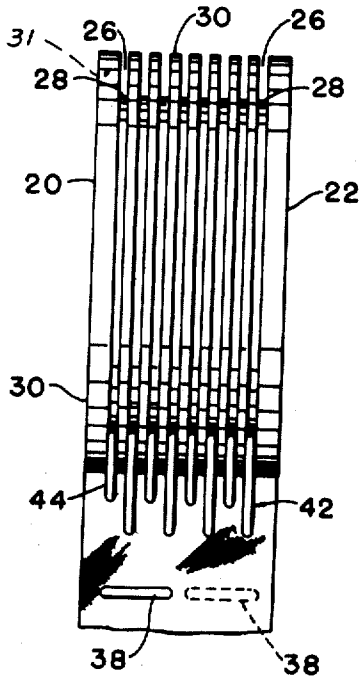


FIG. 3

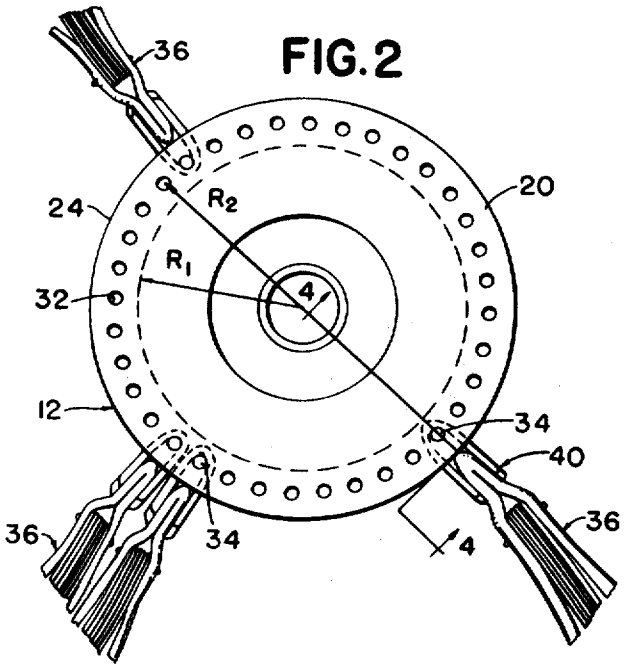


FIG. 2

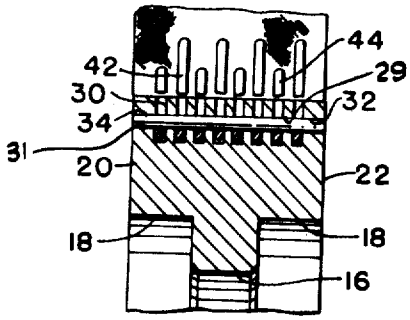


FIG. 4

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FIG. 5

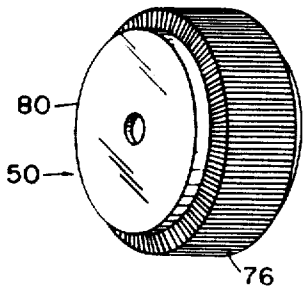


FIG. 6

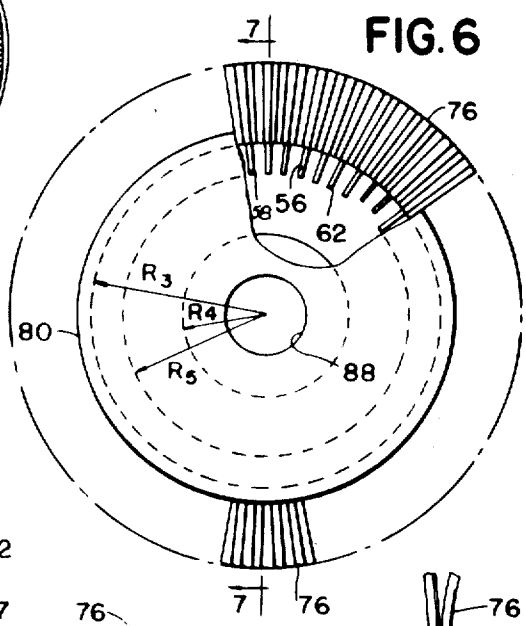
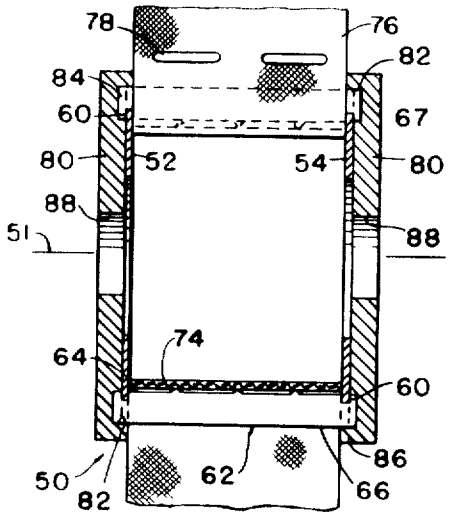


FIG. 7



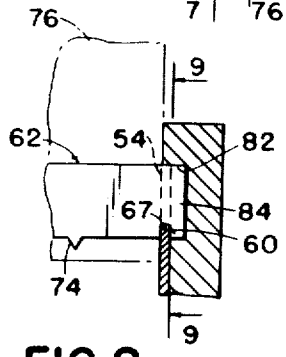


FIG. 8

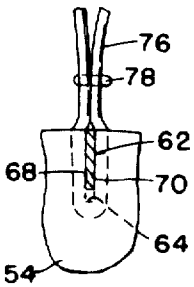


FIG. 9

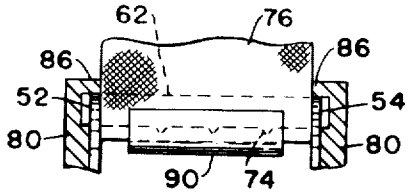


FIG. 10

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FINISHING WHEELS

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Original No. 3,535,833, dated Oct. 27, 1970, Ser. No. 822,776, Feb. 24, 1969, which is a division of application Ser. No. 485,497, Sept. 7, 1965, now Patent No. 3,455,068. Application for reissue Apr. 14, 1971, Ser. No. 133,856

Int. Cl. B21b 9/02

U.S. Cl. 51—337 13 Claims

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

A rotary carrier affords a plurality of annular, axially spaced grooves in its outer surface, and a plurality of parallel pins extend through these grooves and rim portions of the carrier spacing the grooves from one another. The pins parallel the carrier axis, and a plurality of generally radially extending finishing flaps are pivoted on the pins, each flap being provided with retainer loop means on the radially inner end thereof. Such means is received in a carrier groove, the pin extending through the loop opening of the flap retainer means to mount the finishing flap for pivotal movement.

This application is a division of my copending application, Ser. No. 485,497, filed Sept. 7, 1965, now Pat. No. 3,455,068.

This invention relates to a finishing wheel or tool and more particularly to a power driven wheel or tool for finishing metal or other relatively hard surfaces. The invention is particularly adapted for buffing wheels, polishing wheels and like apparatuses for effecting grinding, polishing, brushing, buffing, burnishing and other surfacing operations.

Many of the finishing wheels presently available on the market have certain deficiencies which contribute to the fact that the wheels do not maintain their balance. This is due to the fact that the finishing flaps are not uniformly spaced at the point of attachment to the hub or core. An unbalanced wheel regardless of the cause does not perform an effective or desirable surfacing operation.

The present invention illustrates two forms of finishing wheels which have overcome the aforementioned problems. The finishing wheel of each embodiment maintains its balance throughout its useful life, because the design of each wheel insures uniform distribution of the finishing units or flaps around the hub or core.

One embodiment of the present invention is characterized by utilizing a rotary carrier provided with a series of circumferentially extending outwardly opening grooves. A plurality of axially extending angularly spaced openings are provided in the carrier intermediate the outer periphery of the carrier and the bottom of the grooves. Each opening consists of a plurality of annular bearing points. Located in the bearing points of each opening is a mounting element such as a pin to which a finishing flap is appropriately connected. Each flap and corresponding pin are arranged to pivot with respect to the aforementioned bearing points of the carrier through a small but predetermined angular extent to help maintain the wheel in proper balance.

The other embodiment of the present invention is characterized by having a cartridge consisting of two end plates or fixtures which are spaced axially apart. Each plate is provided in the outer periphery thereof with a plurality of circumferentially spaced radially extending outwardly opening slots. Extending between the aligned pairs of corresponding slots in the end plates are a plurality of anchor pins or elements for mounting the flaps of the finishing tool. Both end plates or fixtures serve several important functions. First of all, the end plates locate each anchor pin at a particular angular location on the periphery or circumference of the wheel. Secondly, the end plates form a five-way lock so that each pin cannot move radially inwardly toward the axis of the tool or move circumferentially in either direction or move lengthwise in either direction parallel to the rotary axis of the wheel. With such a construction the pins are only adapted to move radially outwardly but such movement is prevented by the use of end caps or covers provided with annular grooves which receive the ends of the pins extending beyond the outer surfaces of the end plates or fixtures. The finishing flaps are in turn appropriately connected to the pins and are arranged close together in a pack. The finishing tool or wheel is in balance and such balance is maintained because the pins and flaps are maintained in a fixed position.

It is an object of the present invention to provide a wheel which will remain in balance throughout its useful life.

Another object of the present invention is to provide a finishing tool comprising a rotary carrier having a plurality of circumferentially extending endless grooves in the outer surface of the carrier, a plurality of mounting elements extending axially through the grooves and pivotally carried by the carrier, a plurality of generally radially extending finishing flaps having inner and outer ends, each flap being provided with retainer means on the inner end thereof which is received in the grooves, said mounting elements extending through the retainer means of the finishing flaps so as to constitute the sole means for pivotally mounting the finishing flaps.

Another object of the present invention is to provide a finishing tool of the aforementioned type wherein each of the retainer means is in the form of a belt lacing having a plurality of closed loops and each of the mounting elements is in the form of an elongated pin.

Still another object of the present invention is to provide a finishing tool of the aforementioned type wherein the grooves are of uniform depth.

A further object of the present invention is to provide a finishing tool comprising a rotary carrier having an axis and a pair of axially spaced end plates, said plates having a plurality of radially extending outwardly opening slots therein, the slots in one of the plates being axially aligned with the corresponding slots in the other of the plates, the plates at the bottom of the slots forming retainer means, a plurality of axially extending elongated pins in the slots and fixedly carried by said plates, said pins each having a pair of radially extending downwardly opening slots therein which receive the corresponding retainer means on the plates, and a plurality of generally radially extending finishing flaps connected to the pins.

Another object of the present invention is to provide a finishing tool of the aforementioned type wherein the axial ends of the pins extend radially outwardly beyond the outer surfaces of the plates.

Still another object of the present invention is to provide a finishing tool of the aforementioned type wherein a pair of end covers are provided, each cover having an endless groove therein on the inner surface thereof, each cover being mounted adjacent the outer surface of one of the plates with the ends of the [pines] *pins* extending from said one plate received in the corresponding groove.

A further object of the present invention is to provide a finishing tool of the aforementioned type wherein the covers are in surface to surface contact with the plates.

A still further object of the present invention is to provide a finishing tool of the aforementioned type wherein some of the pins are provided with teeth which engage the inner surfaces of the flaps.

Another object of the present invention is to provide a finishing tool of the aforementioned type wherein each of the pins is connected to a finishing flap by means of a resilient clip.

It is thus another object of this invention to provide a simplified low cost structure of the aforementioned type having certain advantages contributing to efficiency, reliability and long life as well as ease of maintenance.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

FIG. 1 is a perspective view of one embodiment of the present invention.

FIG. 2 is a front elevation of the finishing tool illustrated in FIG. 1.

FIG. 3 is a side elevation of the finishing tool illustrated in FIGS. 1 and 2.

FIG. 4 is a sectional view taken on the line **4—4** of FIG. 2.

FIG. 5 is a perspective view of another embodiment of the present invention.

FIG. 6 is a front elevation of the finishing tool illustrated in FIG. 5, with parts broken away to illustrate important features thereof.

FIG. 7 is a sectional view of the finishing tool taken on the line **7—7** of FIG. 6.

FIG. 8 is a fragmentary view partly in section illustrating the manner in which an [anchpor] *anchor* pin is connected to a fixture or end plate of the finishing tool.

FIG. 9 is a view, partly in section, taken on the line **9—9** of FIG. 8.

FIG. 10 is a fragmentary view partly in section illustrating a resilient clip for connecting a flap to the corresponding anchor pin of a finishing tool.

FIGS. 1–4 illustrate one form of finishing wheel or tool **10**. The tool **10** *is in the form of an abrasive drum which* includes, as an example, a one-piece cylindrical hub or carrier **12** having a rotary axis **14**. The hub **12**, which can also be constructed with more than one piece, is made from a suitable metal such as aluminum or plastic material such as nylon by, as an example, an injection molding operation. An axial bore **16** extends completely through the center of the carrier **12**, with the opposite ends thereof enlarged or counterbored to form recesses **18** in the two end faces or surfaces **20** and **22** as best illustrated in FIG. 4. The hub or carrier **12** is adapted to be mounted on and appropriately secured to a power driven drive shaft, not shown, which extends through bore **16**, in a manner well known and understood in the art.

The outer periphery **24** of the carrier **12** is provided with a pluality of circumferentially extending endless *peripheral recesses or* grooves **26**, *arranged as axially or longitudinally spaced rows,* as an example, a total of eight grooves **26** as shown in FIG. 3. The grooves **26** are of uniform depth and each groove **26** includes an inner or bottom endless surface **28** arranged on a radius R_1, as shown in FIG. 2. The grooves **26** are separated by radially extending relatively thin *peripheral ribs,* rims or walls **30** which are integral with the main portion of the carrier **12**.

The carrier or hub **12** is further provided with a plurality of laterally extending circumferentially spaced *and axially aligned passages,* holes or openings **32** *in its ribs 30, interconnecting the grooves 26 and* having their centers arranged in a circle having a radius R_2 as best illustrated in FIG. 2. The holes **32** are [space] *arranged as a series of rows spaced* circumferentially apart an equal distance. As an example, for *a* carrier having 60 openings **32**, each opening **32** would be spaced 6° from adjacent openings. Each opening **32** extends through the end face **20**, rims **30** and end face **22** intermediate the outer periphery **24** of the hub **12** and the bottom surfaces **28** of grooves **26** so as to form a plurality of spaced annular bearing points. FIG. 3 illustrates each opening **32** as having, as an example, seven bearings points **29** intermediate the two end bearing points **31**.

A plurality of elongated pivot pins *or retainer rods* **34** of circular cross section are *removably or releasably* mounted in each of the aforementioned *passages or* openings **32** and upon which are mounted a series of replaceable finishing flaps **36** *in the form of assemblies or packs of radially and longitudinally extending, flexible abrasive sheets.* The pins **32** may be made from a fibrous or plastic material or from a suitable metal. The finishing flaps **36** may be made from any suitable material presently utilized such as leather, cloth, sisal, coated abrasive cloth or other fibrous material or fabric. The material may be dipped in a solution of resin or other suitable materials so as to vary the hardness of the flap as is conventional in the art.

Each flap **36** is of U-shaped cross section with opposite sides thereof appropriately secured together, as an example by means of staples **38** as shown in FIG. 3. The inner end of each flap **36** is provided *along its radially inner longitudinal edge* with suitable retainer means **40**, *shown* in the form of a belt lacing **42**. The belt lacing **42** includes a plurality of closed loops or elements **44** corresponding in number to the number of grooves **26** provided in the outer periphery **24** of the hub **12**. Continuing with the aforementioned example, eight such elements or loops **44** are provided on each flap **36** [and are], *extending inwardly from the longitudinal flap edge and being* received in the corresponding eight grooves **26** as illustrated in FIGS. 3 and 4. The belt lacing **42** may be clinched or otherwise secured to the flap **36**. After each flap **36** has been provided with the belt lacing **42** in the manner just described the flap **36** is inserted in the carrier **12** with all eight loops **44** received within the grooves **26**. Thereafter a pin **34** is inserted through an opening **32** so as to extend through the end surface **20**, rims **30**, the loops **44** of the belt lacing **42** and finally through the end surface **22** of the carrier **12** as best illustrated in FIG. 4.

The flaps **36** are thus supported by pins **34** so that their ends extend radially outwardly. In addition the flaps **36** are arranged in side by side relationship so as to form a pack of finishing flaps on the hub **12**. By arranging the flaps **36** and pivot pins **34** in the manner just described the flaps **36** are mounted for relatively sight but a predetermined amount of circumferential movement. The amount of movement is dependent on the number of flaps **36** utilized and the location of adjacent flaps **36**.

It has been found that the finishing tool **10** remains in balance throughout the normal life of the finishing flaps **36**. It is believed that this balance is attained due to the fact that the flaps **36** are mounted for a relatively small but a predetermined amount of circumferential movement. It should be noted that the component parts of the finishing tool **10** are constructed and arranged so that the flaps **36** may be readily replaced from time to time as they wear out. To replace the used flaps **36** on the carrier **12** it is first necessary to remove all of the pins **34** and thereby permit the flaps **36** to be withdrawn from the carrier **12**. Thereafter new finishing flaps **36** are mounted on the carrier **12** in a manner described heretofore. A punch or other suitable tool may be used to assist in removing the pins **34**.

It should also be understood that other types of pivot mountings may be utilized in order to pivotally mount the flaps **36** on the carrier **12**.

When the tool **10** is to be used the operator, after connecting the tool **10** to a source of power, brings the rotating carrier into proximity with the work, with its axis of rotation substantially parallel with the surface to be treated, until the ends of the flaps **36** contact the surface as is well known in the art.

FIGS. 5–10 inclusive illustrate another form of a finishing wheel or tool designated by the numeral **50**. The wheel **50** has an axis **51** and includes a cartridge or cage consisting of a pair of relatively thin and flat end plates

or fixtures **52** and **54**. Each plate **52** and **54** is of identical construction and is in the form of annulus or ring. Each plate **52** and **54** includes an outside radius R_3 and an inside radius R_4 as illustrated in FIG. 6. The outer periphery of each plate **52** and **54** is provided with a plurality of circumferentially spaced, radially extending, outwardly opening slots **56**. The bottom surface **58** of each slot **56** is generally located on the radius R_5 as best illustrated in FIG. 6. The slots **56** are equally spaced apart, as an example, every six degrees, and are located at fixed points or places on the outer periphery of the end plates **52** and **54**. Retainer means or abutments **60** are located radially inwardly and below the bottom surfaces **58** of the slots **56** and are used for a purpose to be hereinafter described.

The cartridge or cage further comprises a plurality of transversely extending, circumferentially spaced elongated anchor pins or elements **62** which are inserted in corresponding pairs of aligned slots **56** in the end plates or fixtures **52** and **54**. Each elongated pin **62** is of substantially rectangular cross section and includes an inner edge **64** and an outer edge **66**. The opposite ends of each pin **62** is provided with inwardly extending notches **67** in the inner edge **64**. Each pin **6** is inserted into a pair of aligned slots **56** in end plates **52** and **54**, with the notches **67** fitting over and firmly engaging the retainer means or abutments **60** as best illustrated in FIGS. 7 and 8.

Slots **56** are of uniform depth and width and each slot includes a pair of generally radially extending side walls **68** and **70** which are connected by *the* aforementioned bottom surface **58** adjacent the retainer means or abutment **60**. Each pin **62** is anchored or fixed in a pair of laterally aligned slots **56** in the end plates and completely fills the slots, with the outer edge **66** of the pin **62** even with the outer periphery of the end plates located on radius R_3.

Each pin **62** is provided on the inner edge **64** with inwardly extending prongs or projections **74**, as an example, three in number. Finishing flaps **76** are appropriately connected to the anchor pins **62**. The finishing flaps **76** are of U-shaped configuration with opposite sides thereof appropriately connected together around pins **62**, as an example by means of staples **78** as shown in FIGS. 7 and 9. The flaps **76** may be made from any suitable material presently utilized such as sisal, coated abrasive cloth, cloth or other suitable fibrous materials or fabrics. The material may be dipped in a solution of resin or other suitable materials so as to vary the hardness of the flaps as is conventional in the art. The finishing flaps **76** extend radially outwardly and may be of any predetermined length. The finishing flaps **76** are also arranged in side by side relationship so as to form a relatively tight pack of finishing flaps. The prongs **74** provided on the pins **62** grip the inner surface of the finishing flaps **76** so as to hold the inner ends of the flaps **76** in a fixed position.

The end plates or fixtures **52** and **54** serve a number of important functions. The end plates locate each anchor pin **62** at a particular angular location on the periphery or circumference of the wheel. Thus a pair of aligned slots **56** locate the corresponding pin **62** at a given location on the circumference of the plates **52** and **54**. The end plates **52** lock each pin **62** so that the pin cannot move radially inwardly toward the axis of the tool **50** or move circumferentially in either direction, or move lengthwise in either direction parallel to the rotary axis **51**.

The plates **52** and **54** thus form a five-way lock with respect to each pin **62**. The plates **52** and **54** prevent each pin **62** from moving radially inwardly as well as lengthwise in both directions parallel to the axis **51** due to the engagement of the abutments **60** with the surfaces defining the slots **67** in the pin **62**. In addition the side surfaces of each pin **62** are in surface to surface contact with the side walls **68** and **70** of corresponding pairs of aligned slots **56**. With such a construction the pins **62** are prevented from moving circumferentially or sideways in opposite directions. While the pins **62** are adapted to move radially outwardly such movement is prevented by the provision of a pair of end caps or covers **80**. Each end cap or cover **80** is provided with a circumferentially extending endless groove **82** which is adapted to receive the overhanging end portions **84** of the pins **62** which project laterally beyond the outer surfaces of the end plates or fixtures **52** and **54**. The grooves **82** have a uniform depth equal to the length of the overhanging portions **84**. The outside diameter of the grooves **82** is approximately equal to the outside diameter of the end plates **52** and **54** while the inside diameter of the grooves **82** is approximately equal to the outside diameter of the end plates less the width of two pins **62** measured along the diameter of the wheel.

Each cover **80** further includes an annular rim **86** which engages the edges of the finishing flaps **76** as best illustrated in FIG. 7. Each cover **80** is provided with a centrally located hole or opening **88**. The tool **50** is adapted to be mounted on and appropriately secured to a power driven shaft not shown, which extends through the centrally located openings in the wheel **50**, in a manner well known and understood in the art.

The cartridge or cage including the end plates **52** and **54**, pins **62**, and finishing flaps **76** form a unit which is replaceable after wear. The end covers **80** which engage the outer surfaces of the end plates **52** and **54** when assembled as tool **50** are reusable with new cartridges.

The end plates **52** and **54**, and pins **62** are made, as an example, from steel of sufficient strength which will withstand all of the forces normally encountered when the tool is used at high speeds in a surfacing operation. The end covers **80** may be made from aluminum or other suitable metals. The end plates **52** and **54** do not bend or buckle under normal use. The pins **62** also withstand the extreme forces tending to bend or buckle same laterally or lengthwise. Thus the cartridge is constructed and arranged to resist continuously the relatively extreme forces which are applied when the wheel **50** is rotated at high speeds in a conventional surfacing operation.

When all of the finishing flaps **76** are in place, the side surfaces of each flap are disposed in bearing engagement with the surfaces of the flaps **76** on each side. Each flap **76** thus reinforces and strengthens the others against any excessive circumferential bending at the secured ends. The rims **86** on the covers **80** help to fix the inner ends of flaps **76**.

The finishing tool **50** is balanced due to the aforementioned features and such balance is maintained due in part to the fact that the pins **62** and finishing flaps **76** are maintained in fixed position.

FIG. 10 illustrates another way of connecting a finishing flap **76** to an anchor pin **62** rather than using staples **78**. A resiliently biased spring steel clip **90** of U shaped cross section is inserted over the inner end of the folded flap **76** so as to urge the sides of the flap **76** firmly against the pin **62**.

It should also be appreciated that other forms of retainers may be utilized to prevent the pins **62** from moving radially outwardly. As an example, a retainer in the form of a ring or annulus could be utilized around the outer periphery of the overhanging end portions **84** of the pins **62** to prevent same from moving radially outwardly.

It has been found through actual use under normal operating conditions that the wheel **50** has a useful life substantially greater than that of similar wheels. Such tests have indicated that the pins **62** do not twist or turn and that no ripping of the flaps **76** occurs.

The drawings and the foregoing specification constitute a description of the improved finishing wheels in such full, clear, concise and exact terms as to enable any per-

son skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A finishing tool comprising a rotary cylindrical carrier having an axis, a plurality of circumferentially extending endless rims defining grooves of uniform depth therebetween in the outer surface of said carrier, a plurality of pins extending axially through said rims and said grooves and pivotally carried by said carrier, a plurality of generally radially extending finishing flaps having inner and outer ends, each flap being provided with retainer means on the inner end thereof which is received in said grooves, said pins extending through the retainer means of said finishing flaps so as to constitute the sole means for pivotally mounting said finishing flaps *yet being axially removable from said rims and retainer means to permit replacement of the flaps.*

[2. A finishing tool comprising a rotary carrier having an axis and a plurality of circumferentially extending endless annular grooves in the outer surface of said carrier and centered at said axis, a plurality of pins extending axially through said grooves and carried by portions of said carrier, a plurality of generally radially extending finishing flaps having inner and outer ends, each flap being provided with retainer means on the inner end thereof which is received in said grooves, said pins extending through the retainer means of said finishing flaps so as to constitute the sole means for pivotally mounting said finishing flaps.]

3. The finishing tool defined in claim [2] *1* wherein each of said retainer means is in the form of a belt lacing having a plurality of closed loops.

4. The finishing tool defined in claim [2] *1* wherein said rotary carrier is provided with an axially extending recess in each of the side faces thereof.

[5. The finishing tool defined in claim 2 wherein said gooves are of uniform depth.]

6. The finishing tool defined in claim [2] *1* wherein said rotary carrier is in the form of a one-piece cylindrical hub.

7. A finishing tool comprising a rotary carrier having an axis, a plurality of circumferentially extending endless grooves in the outer surface of said carrier, said carrier including annular rims intermediate said grooves, a plurality of angularly spaced openings extending through said rims and the end surfaces of said carrier, each opening being defined by a series of annular bearing points in said rims, a plurality of pins extending through said openings and pivotally carried by the bearing points on said carrier, a plurality of generally radially extending finishing flaps having inner and outer ends, each flap being provided with retainer means on the inner end thereof which is received in said grooves, said pins extending through said opening and the retainer means of said flaps so as to mount said finishing flaps for pivotal movement.

[8. The finishing tool defined in claim 2, in which said pins are pivotally mounted by said carrier portions.]

9. In an abrasive drum, the combination of:

a hub of rigid material formed with a series of peripheral circumferential ribs separated by grooves,

each of said ribs having a series of circumferentially spaced openings therein, said openings being aligned in a series of rows extending longitudinally of the hub;

a circumferential series of spaced assemblies of abrasive sheets corresponding to said series of rows and positioned longitudinally of the hub,

each assembly having longitudinally spaced anchoring elements extending into the grooves of the hub along one of said rows; and

elongated retainer members extending through said rows of openings respectively in engagement with both said ribs and said anchoring elements to secure the assemblies to the hub.

10. A combination as set forth in Claim 9, in which said anchoring elements extend around the retainer members.

11. A combination as set forth in Claim 9, in which said grooves are spaced longitudinally from one another by said ribs in the direction of the axis of the hub,

said anchoring elements being fixed securely to each of the respective sheet assemblies adjacent a radially inner edge thereof,

and being spaced from one another in substantial correspondence with the longitudinal spacing of said grooves for engagement with the retainer members between said ribs.

12. A combination as set forth in Claim 10, in which said grooves are spaced longitudinally from one another by said ribs in the direction of the axis of the hub,

said anchoring elements being fixedly secured to each of the respective sheet assemblies adjacent a radially inner edge thereof,

and being spaced from one another in substantially correspondence with the longitudinal spacing of said grooves for engagement with the retainer members between said ribs.

13. A finishing tool comprising a rotary carrier having an axis and a plurality of circumferentially extending endless annular grooves in the outer surface of said carrier and centered at said axis, a plurality of pins extending axially through said grooves and carried by portions of said carrier, a plurality of generally radially extending finishing flaps having inner and outer ends, each flap being provided with retainer means on the inner end thereof which is received in said grooves, said pins extending through the retainer means of said finishing flaps.

14. The finishing tool defined in Claim 13, wherein said carrier has axially opposite end face members centered at said axis, between which end face members said annular grooves are located, the grooves being spaced axially by intermediate rib members coaxial with said face members, each of said flaps extending axially endwise across said grooves and end face members, the latter and said rib members having axially extending and aligned openings receiving said pins, with each pin received in common by aligned end face and rib member openings.

15. The finishing tool defined in Claim 13, wherein said retainer means is fixedly secured to each of said finishing flaps adjacent said inner end thereof.

16. The finishing tool defined in Claim 14, wherein said retainer means is fixedly secured to each of said finishing flaps adjacent said inner end thereof.

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The following references, cited by the Examiner, are of record in the patented file of this patent or the original patent.

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