Nov. 23, 1971 J. A. BELANGER 3,621,622

ADJUSTABLE WIDTH ROTARY FINISHING TOOL

Filed Sept. 10, 1969

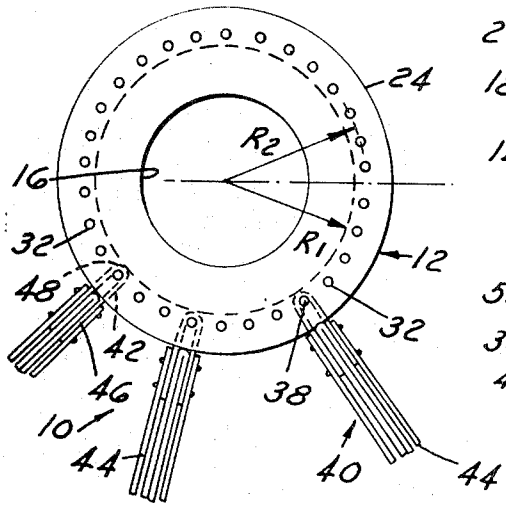


FIG. 1

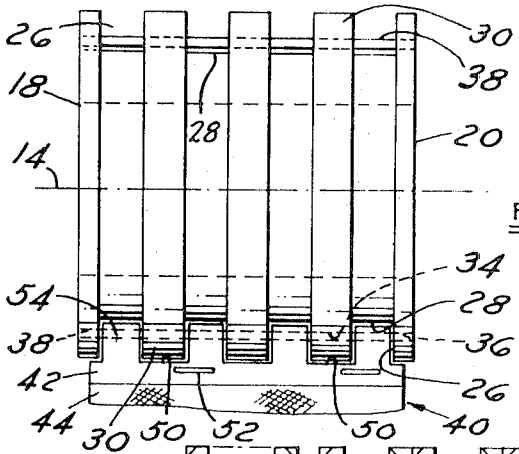


FIG. 2

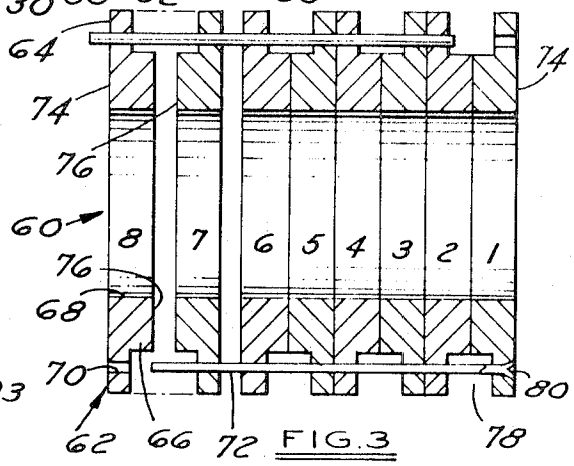


FIG. 3

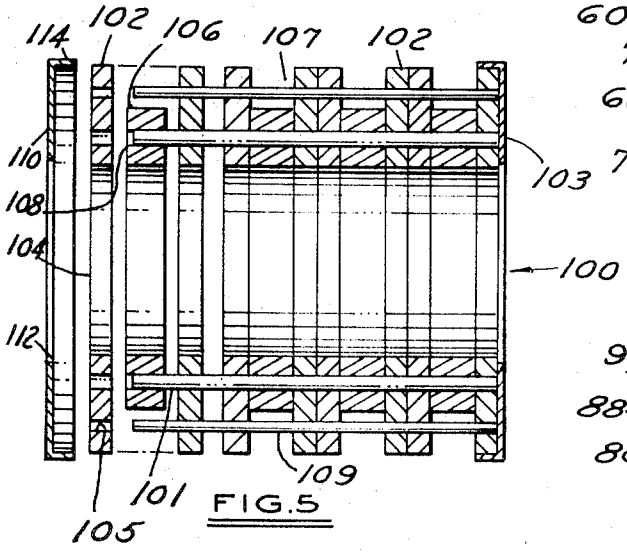
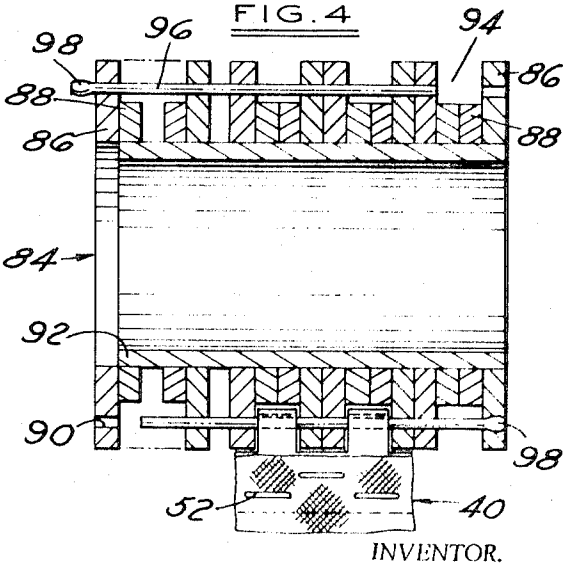


FIG. 5

FIG. 4



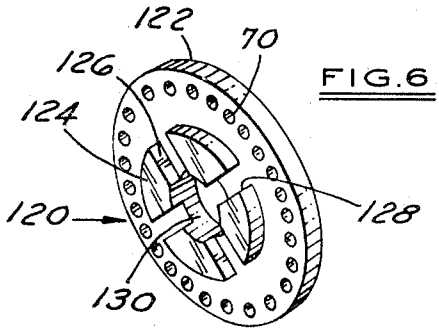


FIG. 6

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United States Patent Office 3,621,622
Patented Nov. 23, 1971

3,621,622

ADJUSTABLE WIDTH ROTARY FINISHING TOOL

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Filed Sept. 10, 1969, Ser. No. 856,773
Int. Cl. B24b 9/02
U.S. Cl. 51—337 2 Claims

ABSTRACT OF THE DISCLOSURE

The adjustable width rotary finishing tool comprises a carrier or hub made from a plurality of discs or elements arranged in side by side abutting relationship. The hub includes a plurality of circumferentially extending endless grooves or channels in the outer surface of the hub. The hub includes annular rims adjacent the grooves, with the grooves and rims being formed by the discs. A plurality of radially spaced openings extend longitudinally through the rims and the end surfaces of the hub, each opening being defined by a series of annular bearing points. A plurality of generally radially extending finishing flaps are provided with retainer means on the inner ends thereof which extend into the grooves of the hub in alignment with the corresponding bearing points. Pivot pins extend through the openings and the retainer means of the flaps. With such a construction the finishing flaps and corresponding pins are arranged to pivot through a small predetermined angular movement to help maintain the wheel in proper balance. The length of the hub may be increased by adding discs to the hub or the length may be decreased by removing discs from the hub.

CROSS-REFERENCE TO RELATED APPLICATIONS

My copending application, Ser. No. 822,776, filed Feb. 24, 1969, now U.S. Pat. No. 3,535,833 dated Oct. 27, 1970, entitled "Finishing Wheels," discloses and claims a finishing tool having a rotary hub and a plurality of generally radially extending pivotally mounted finishing flaps. My copending application, Ser. No. 857,885, entitled "A Finishing Flap Assembly," filed Sept. 15, 1969, discloses a replaceable finishing flap assembly for use in the finishing tool of the present invention.

BACKGROUND OF THE INVENTION

Field of the invention

The adjustable width rotary finishing tool of the present invention finds application in the metal finishing industry for buffing wheels, polishing wheels, grinding wheels and the like apparatuses for effecting buffing, brushing, burnishing, polishing, grinding and other surface finishing operations on metal or hard workpieces.

SUMMARY OF THE INVENTION

The improved adjustable width rotary finishing tool is of a very simple and inexpensive construction and one in which the discs or elements, which are stacked in side by side relationship to form the hub, may be fabricated by a stamping, casting, molding or by a machining operation or the discs may be made by a combination of said operations. A tool of any desired length may be constructed by merely adding or substituting discs to or from the hub structure. The discs may be radially aligned by use of a pair of rods or by mounting the discs on a sleeve and fixedly securing the discs thereto, as an example, by welding or brazing. The ends of the pins which provide the sole pivot support for the finishing flaps are staked, cold headed or capped in such a manner to hold the tool together as a unit but which permits removal of the pins and the corresponding finishing flaps from the hub for replacement of used flaps or in some instances for increasing or decreasing the length of the hub. The finishing flaps are uniformly spaced at the point of attachment to the hub and are mounted for a small but predetermined angular extent to help maintain the wheel in proper balance throughout its useful life.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of a finishing tool, with the majority of the finishing flaps removed, of the type disclosed in my copending application, U.S. Ser. No. 822,776.

FIG. 2 is a side elevational view of the finishing tool illustrated in FIG. 1.

FIG. 3 is a longitudinal sectional view of an adjustable width rotary hub having a plurality of elements or discs arranged in side by side abutting relationship.

FIG. 4 is a longitudinal sectional view of another embodiment of the adjustable width rotary hub.

FIG. 5 is a longitudinal sectional view of still another embodiment of the adjustable width rotary hub.

FIG. 6 is a perspective view of a modified disc for use in any of the hub structures illustrated in FIGS. 3–5 inclusive.

DESCRIPTION OF A PREFERRED EMBODIMENT

FIGS. 1 and 2 illustrate a rotary finishing tool or wheel **10** of the type described and claimed in my copending application U.S. Ser. No. 822,776 (now U.S. Pat. No. 3,535,833), aforesaid. The tool **10** includes a one piece cylindrical hub or carrier **12** having a longitudinal rotary axis **14**. The hub **12** may be machined out of metal or plastic bar, block or tubular materials. Suitable metals which may be used are steel and aluminum. A suitable plastic material is nylon. In addition, the hub **12** may be cast or molded. An axial bore **16** extends completely through the center of the hub **12**, with the opposite ends thereof being flat and defining end surfaces **18** and **20**. The hub **12** is adapted to be mounted on and appropriately secured to a power driven shaft, not shown, which extends through bore **16**, in a manner well known and understood in the art.

The outer periphery **24** of the hub **12** is provided with a plurality of circumferentially extending endless grooves **26**. As an example, a total of four grooves **26** are illustrated in FIG. 2. The grooves **26** are of uniform depth and each groove **26** includes an inner or bottom annular surface **28** arranged on a radius R_1 as shown in FIG. 1. The grooves **26** are separated by radially extending rims or walls **30** which are integral with the main portion of the hub **12**.

The hub **12** is further provided with a plurality of equally spaced longitudinally extending holes or openings **32** having their centers arranged in a circle having a radius R_2 as illustrated in FIG. 1. The holes **32** are spaced apart an equal distance. As an example, for a hub **12** having thirty openings **32**, the center of each opening **32** would be spaced 12 degrees from adjacent openings. Each opening **32** extends through the end face **18**, rims **30** and end face **20** intermediate the outer periphery **24** of the hub **12** and the bottom or inner annular surfaces **28** of grooves **26** so as to form a plurality of longitudinally spaced annular bearing points or areas. FIG. 2 illustrates each opening **32** as having three bearing points **34** intermediate the two end bearing points **36**.

A plurality of elongated pivot pins **38** of circular cross section are mounted in each of the aforementioned openings **32** and upon which are mounted a series of replaceable finishing flaps **40**. The pins **38** may be made from a fibrous or plastic material or from a suitable metal. The finishing flaps **40** 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 **40** as is conventional in the art.

Each finishing flap assembly **40** has an elongated retainer **42** and a pack of flexible material **44**. Retainer **42** is of general U-shaped cross section having a pair of legs **46** and a curved connecting portion **48**. The retainer **42** includes a plurality of longitudinally spaced notches **50** with the notches **50** extending through the curved connecting portion **48** and extending towards the middle portion of the legs **46**. The pack of flexible material **44** has one edge portion thereof interposed in the retainer **42** between the legs **46**. A plurality of fastening elements such as staples **52** extend transversely through the pack **44** and legs **46**, each fastening element securing the flexible material **44** in a compressed condition to lock the flexible material **44** to the retainer **42**.

The portions of the retainer **42** intermediate the notches **50** form hinge type U-shaped sockets **54** which extend into grooves **26** of the hub **12** as illustrated in FIG. 2. The pin **38** is inserted through opening **32** so as to extend through the end surface **18**, rims **30**, sockets **54** and finally through the end surface **20** of hub **12**.

The flaps **40** are thus supported by pins **38** so that their outer ends extend radially outwardly. In addition the flaps **40** are arranged in side by side relationship so as to form the pack of finishing flaps **40** on the hub **12**. By arranging the flaps **40** and pivot pins **38** in the manner just described the flaps **40** are mounted for relatively slight but a predetermined amount of circumferential movement. The amount of movement is dependent on the number of flaps **40** utilized and the spacing thereof on the hub.

It has been found that the finishing tool **10** remains in balance throughout the normal life of the finishing flaps **40**. It is believed that this balance is attained due to the fact that the flaps **40** 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 **40** may be readily replaced from time to time as they wear out. To replace the used flaps **40** on the hub **12** it is first necesary to remove all of the pins **38** and thereby permit the flaps **40** to be withdrawn from the hub **12**. Thereafter new finishing flaps **40** are mounted on the hub **12** in a manner described heretofore. A punch or other suitable tool may be used to assist in removing the pins **38**.

When the finishing tool **10** is to be used the operator, after connecting the tool **10** to a source of power, brings the rotating hub into proximity with the work, with its axis of rotation substantially parallel with the surface to be treated, until the ends of the flaps **40** contact the surface as is well known in the art.

The specific finishing tool **10** illustrated in FIGS. 1 and 2 has an outside diameter of 4" and a length of 4". The diameter of bore **16** is

$$2.010''^{+.000}_{-.005}$$

The diameter of annular surface **28** (equals 2_{R_1}) is 3" while the diameter of the base circle for holes **32** (equals 2_{R_2}) is $3\frac{11}{32}$". The holes **32** each have a diameter of $\frac{5}{32}$". There are thirty holes **32** spaced 12° apart. The two end rims each has a thickness of .250" while the three intermediate rims each has a thickness of .490". The width of each groove is .510".

In FIG. 3 the hub **60** when assembled is similar in construction and function to hub **12** with the exception that hub **60** comprises a plurality of identical or similar elements or discs **62** arranged in side by side abutting relationship. With such a construction it is possible to construct a hub **60** of any required length. Each disc **62** includes a rim part **64** having a diameter of 4" and a spacer part **66** having a diameter of 3". The total width of disc **62** is .500" with the thickness of the rim part **64** being .245" and the thickness of the spacer part being .255". For a hub **60** having a length of 4", eight discs **62** are required. Each disc **62** has a centrally located bore **68** having a diameter of

$$2.010''^{+.000}_{-.005}$$

The discs **62** may be fabricated by a stamping, molding or casting operation. As an example, discs **62** could be in the form of aluminum or zinc die castings, or injection molded or machined individually if required. The rim part **64** is provided with a plurality of holes **70** which are arranged on a base circle having a diameter of $3\frac{7}{32}$". Thirty holes **70** are employed and are equally spaced 12° apart. The holes **70** extend through the rim part **64** parallel to the axis of the bore **68**. The holes **70** form bearing points for the pivot pins **72**.

The eight discs **62** shown in FIG. 3 are designated Nos. **1–8** inclusive. Each disc **62** has a rim face or surface **74** and a spacer face or surface **76**. In assembly, a pair of pins **72** are first inserted into holes **70** of the end disc No. **1**. The two pins **72** will initially serve as means for properly aligning the discs during the assembly thereof. Disc No. **1** is placed with the rim surface **74** facing to the right. Disc No. **2** is inserted over the pins **72** until the spacer surface **76** thereon abuts the spacer surface **76** of disc No. **1** to provide a groove **78** which is equal to twice the thickness of spacer part **66**. Disc No. **3** is inserted over the pins **72** with the rim surface **74** being brought into contact with the corresponding rim surface **74** on Disc No. **2**. Disc No. **4** is inserted over the pins **72** with spacer surface **76** being brought into contact with the corresponding spacer surface **76** on Disc No. **3**. This sequence of assembly is repeated in order to form the additional grooves **78** until finally Disc No. **8** is inserted over the pins **72** with the rim surface **74** facing to the left as illustrated.

After the discs **62** have been arranged in the manner just described, with the holes **70** in proper alignment, the pins **72** and replaceable finishing flaps **40** as described previously are inserted the hub **62**, one by one, until all thirty flaps **40** have been properly installed. It will of course be necessary to remove the two pins **72** used during the assembling of the discs and to reinsert same after inserting the corresponding flaps. Thereafter one end of each pin **72** is staked or headed at **80** to enlarge same. As an example, half of the pins **70** are staked adjacent rim surface **74** of Disc No. **1** and the other half are staked adjacent rim surface **74** of Disc No. **8**. With such a construction the staked heads **80** will prevent separation of the discs **62** during use. However when the flaps **40** have worn they can still be replaced by first removing one set of pins **72** from one end of the hub and then removing the other set of pins **72** from the other end of hub **60**. The finishing flaps **40** and pins **72** are arranged to pivot through a small predetermined angular movement to help maintain the wheel or tool in proper balance as is achieved with tool **10** described previously.

In FIG. 4 the modified hub **84** when assembled is similar in construction and function to hub **60** with the exception that the rim part and spacer part are not fabricated in one piece as with disc **62**. Hub **84** comprises a plurality of rings or rims **86** and a plurality of spacers **88** which may be fabricated according to the process described for discs **62**. Rings **86** each have a uniform thickness of .245", an outside diameter of 4" and an inside diameter of

$$2.010'' \pm^{.000}_{.005}$$

As with the other embodiments, a plurality of holes **90** defining bearing points are provided in each rim or ring **86** on a pitch circle having a diameter of $3\frac{11}{32}$". Holes **90** are of the same size and are equally spaced as described in connection with the embodiment in FIG. 3. Spacers **88** each has an outside diameter of 3", an inside diameter of

$$2.010'' \pm^{.000}_{.005}$$

and a thickness of .255".

In assembly the rims **86** and spacers **88** are mounted upon a tubular sleeve **92** having a length corresponding to the length of the tool. One rim **86** is initially provided with a pair of temporary guide pins **96** which have previously been formed with enlarged heads **98**. Thereafter, two spacers **88** are inserted on sleeve **92** and are brought into engagement with rim **86**. Next a pair of rims **86** are inserted over the sleeve **92** and the alignment pins **96** and are brought into engagement with the spacers **88** in order to form the first groove **94**. The aforementioned sequence is repeated by next inserting two additional spacers **88** followed by the insertion of two rims **86**, etc., until the hub **84** is of the requisite length.

After the rims **86** and spacers **88** have been arranged in the manner just described, with the holes **90** in proper alignment, pins **96** and replaceable finishing flaps **40** as described previously are inserted in the hub **84**, one by one, until all thirty flaps **40** have been properly installed. It will, of course, be necessary to remove the two alignment pins **96** and to insert the corresponding finishing flaps **40** in the hub **84**.

In installing the pins **96**, half are inserted in hub **84** adjacent one end surface thereof and the other pins **96** are inserted in the hub adjacent the other end surface thereof. With such a construction approximately an equal number of heads **98** of pins **96** will be located in each end rim of the hub **84** in order to prevent separation of the rims **86** during use. However, when the flaps **40** have been worn they can still be replaced by first removing one set of pins **96** from one end of the hub and then removing the other set of pins **96** from the other end of the hub **84**. As with the other embodiments, the finishing flaps **40** and pins **96** are arranged to pivot through a small predetermined angular movement to help maintain the wheel in proper balance as is achieved with tool **10** previously described.

It may be required or desired to fixedly secure the rims **86** and spacers **88** on the sleeve **92**. This would be accomplished by bonding, welding, brazing or keying the component parts **86**, **88** to the sleeve **92** upon assembly on the sleeve. With such a construction the holes **90** in the rims **86** would be aligned longitudinally and spacers **88** would be prevented from rotating.

It should be understood that the rims **86** and spacers **88** may be made of any width to accommodate finishing flaps having thereon various types or kinds of lacings or clinchers.

The hub **100** illustrated in FIG. 5 is similar in dimensions and construction to the hub **84** illustrated in FIG. 4 with the exception of the provisions of alignment rods **101** and end caps **103**. The plurality of rims **102** and spacers **106** are arranged in side by side abutting relationship as illustrated. Each rim **102** is provided with two additional holes **104** (besides the thirty pin holes **105**) and each spacer **106** is provided with two holes **108**. Hub **100** utilizes spacers **106** having a thickness of .510" equal to the width of the grooves **107** in the hub **100**.

In assembly, the pair of alignment rods **101**, which are of circular cross section, are inserted into the aligned holes **104**, **108** of the rims **102** and spacers **106** respectively to prevent same from rotating and to insure proper longitudinal alignment of the pin openings **105** in rims **102**. After the rims **102** and spacers **106** have been assembled, the usual pivot pins **109** and finishing flaps **40** are inserted into the aligned pin openings **105**, one by one, until the flaps **40** are installed. Each end cap **103** includes a plate **110** with a centrally located

bore **112** and a flange **114**. After the flaps **40** have been installed in hub **100**, end caps **103** are placed over the ends, with flanges **114** frictionally engaging the outer periphery of the end rims **102**. The end caps **103** hold the pins **109** and rods **101** in the hub **100**. The flaps **40** when worn can be replaced by removing end caps **103** and pins **109**. Rods **101** will hold the spacers and rims together. By using end caps **103** it is not necessary to stake the pins **109** or to use pins with enlarged heads as with hub **60** and hub **84** respectively.

FIG. 6 illustrates a modified disc **120** including a rim part **122** and a spacer part **124**. Disc **120** has substantially the same dimensions and construction as discs **62** of hub **60** and in addition includes a pair of radially extending slots **126** and **128** in spacer part **124**. Slots **126**, **128** extend radially outwardly in both directions from the centrally located bore **130** to the outer periphery of the spacer part **124**. Discs **120** can be used in hub **60** in place of some or all of the discs **62**. The slots **126**, **128** provide radial or axial passages for the flow of air in order to help to dissipate heat generated during use of the tool or wheel. The intensity of the heat is greater near the center area of the wheel than on the outer periphery thereof.

I claim:

1. An adjustable width rotary finishing tool having a longitudinal axis comprising a hub having a plurality of coaxial discs arranged in side by side abutting relationship along the axis, each of said discs including a rim part of relatively larger diameter having a cylindrical uninterrupted outer surface and a spacer part integral with the rim part of relatively smaller diameter and having a cylindrical uninterrupted outer surface, the spacer parts on a pair of adjacent discs having flat end surfaces which abut, the outer surfaces on the spacer parts of adjacent discs cooperating with the oppositely facing flat end surfaces of the corresponding rim parts to define a circumferentially extending endless groove on the outer periphery of said hub, a plurality of radially spaced openings extending longitudinally through said rims and the end surfaces of said hub, each opening being defined by a series of longitudinally aligned annular bearing points in said rims, a plurality of pins extending through said openings and carried by the bearing points on said hub, 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 extend into said grooves in alignment with the corresponding bearing points, said pins extending through said openings and the retainer means of said flaps to mount said finishing flaps and means provided to hold the discs in assembled relation.

2. The adjustable width rotary finishing tool of claim **1** wherein the spacer part on at least one of said discs includes slots extending radially from the center to the outer surface thereof to provide passages for a flow of air to dissipate heat generated during use of the tool.

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