

Oct. 13, 1959

E. W. HALL

2,908,117

ROTARY POLISHING ELEMENT

Filed July 26, 1957

2 Sheets-Sheet 1

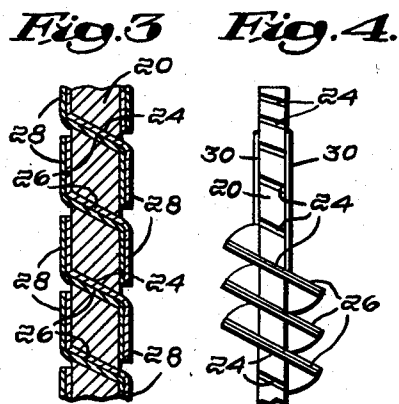
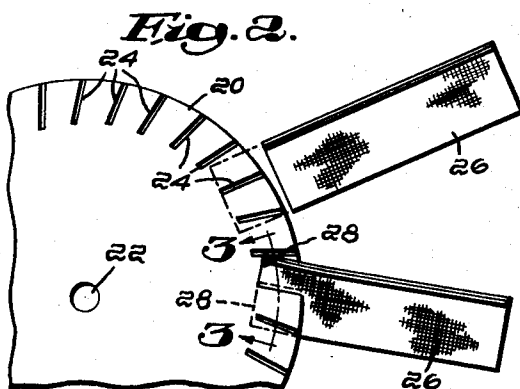
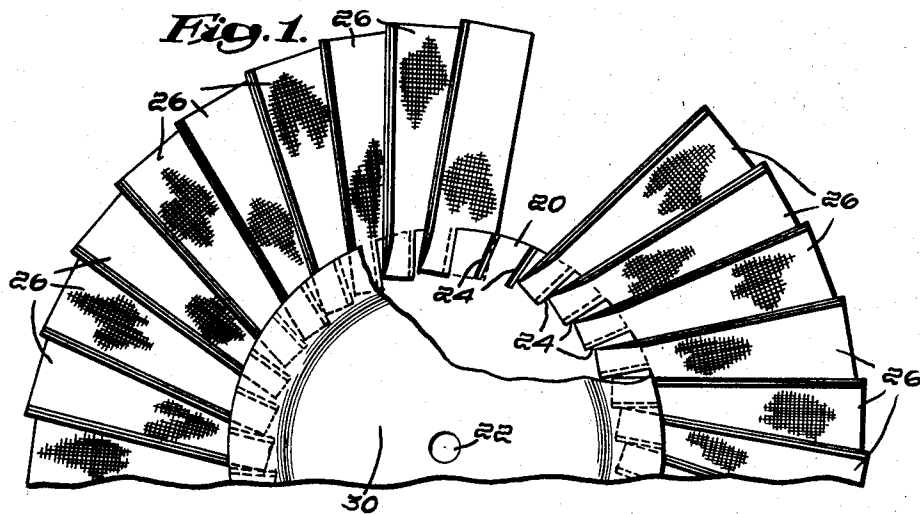


Fig. 6.

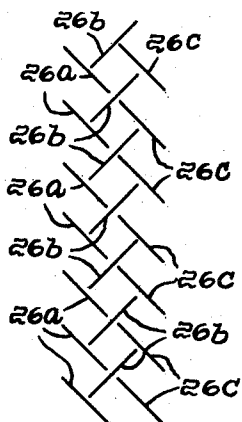
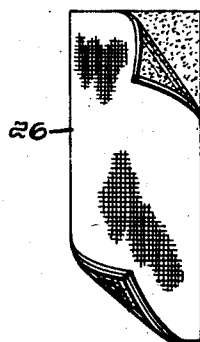


Fig. 5.



Inventor:
Elisha W. Hall,
By Emory, Booth, Townsend,
Mitch & Weidner Attys

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Fig. 7.

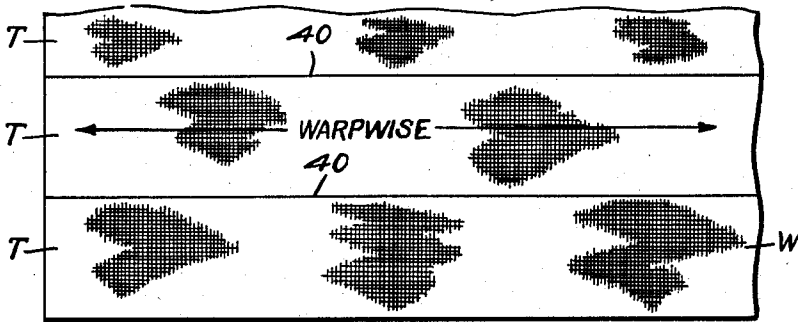


Fig. 8.

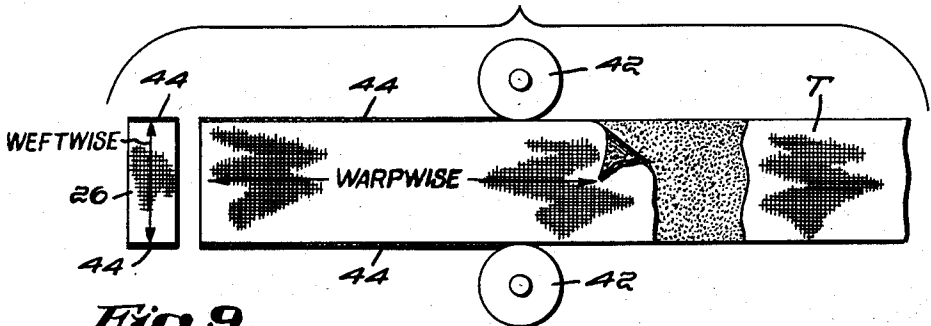


Fig. 9.

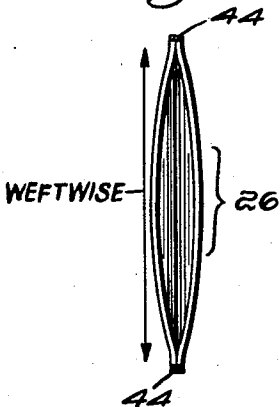
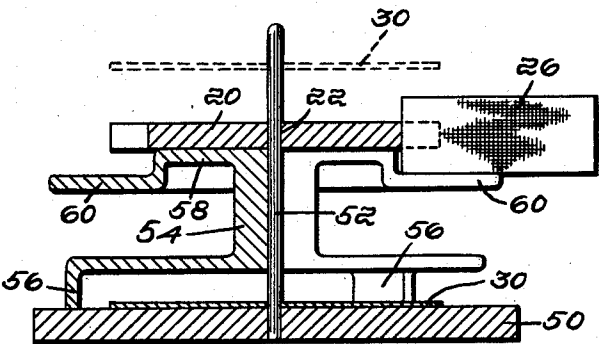


Fig. 10.



Inventor:
Elisha W. Hall,
By Emory, Booth, Townsend
Miller & Widner Attys

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2,908,117

ROTARY POLISHING ELEMENT

Elisha W. Hall, Scituate, Mass., assignor to F. L. & J. C. Codman Company, Rockland, Mass., a corporation of Massachusetts

Application July 26, 1957, Serial No. 674,428

9 Claims. (Cl. 51—193.5)

This invention relates to a rotary abrading tool of generally cylindrical form which may be a generally unitary element which might be used alone as a "wheel," having then usually a rather narrow face, or as a constituent of a "wheel" of relatively broad face consisting of a plurality of such elements suitably arranged side by side.

In my application, Serial No. 603,091 filed August 9, 1956, which issued as Patent No. 2,819,567, dated January 14, 1958, I have disclosed such an element or "wheel" comprising a center or hub and a number of fingers or strips of flexible sheet material coated with abrasive granules (material such as emery cloth), the inner end portions of which strips are secured to the disc with their outer end portions projecting from the disc, the whole being an expendable unit. The element which I am about to describe is similar in the sense that the description in the preceding sentence accurately applies thereto.

In one aspect of the present invention it is an improvement of an element or wheel as described in the above identified case, but certain features disclosed herein are different and have an extended usefulness in a specific field. The wheel as formerly disclosed is very quick cutting and must be used with very little pressure. Certain features hereinafter described permit a more effective use for polishing where little actual removal of stock is involved. In such a case the abrading (using that word in a generalized sense) is effected by the granules at the tips of the strips and, as these granules are used up, that portion of the carrier fabric to which they were adhered also disintegrates and dissipates, so that the strip is gradually and uniformly worn away at one end as if it were a homogeneous body.

My invention will be well understood by reference to the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a partial side elevation of an element or "wheel" with parts broken away;

Fig. 2 is a side elevation of a portion of the hub illustrating the application of the strips thereto;

Fig. 3 is a section on line 3—3 of Fig. 2 on an enlarged scale;

Fig. 4 is an edge view of a portion of Fig. 1, but with many of the strips omitted for clearness;

Fig. 5 is an elevation of one of the strips with parts turned back;

Fig. 6 is a diagrammatic edge view developed in a plane illustrating by single lines end portions of strips of three elements set side by side to form a wheel of wider face;

Fig. 7 is a fragmentary diagrammatic plan view of a web of emery cloth illustrating an initial step in a suitable and preferred method of manufacture;

Fig. 8 is a similar view with parts broken away, illustrating a further step;

Fig. 9 is an edge view of one of the strips as produced in accordance with Fig. 8; and

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Fig. 10 is a central section illustrating a further step in assembling the strip by means of a suitable appliance.

Referring now to the drawings. Each element, and it will be recalled that a single element may be used alone as an abrading wheel, may comprise a center in the form of a circular disc 20, desirably formed from fiber board or binder's board. These words are not used in any technical sense except insofar as, like the word "card-board," they suggest a relatively cheap and expendable material such as may be made from agglomerated fibers. The word "board" suggests a certain substantial thickness, although small in comparison with superficial area. The center 20 has a central opening 22 to receive a shaft. At suitable intervals around the periphery of the board it is slotted diagonally to the axis of opening 22, as best seen in Fig. 3, and the slots 24 are preferably arranged at a slight angle to the radial, as seen in Fig. 2. In these slots are mounted what I will here refer to as "strips" of flexible material coated with abrasive granules, in the nature of emery cloth or sandpaper. Usually a woven cloth will be utilized. The strips 26, considered as a whole, are of substantially greater width than the thickness of the center 20, and of considerable length to provide upstanding projecting portions, their length in the example shown being greater than their width.

In Fig. 2 at the upper right is seen a two-ply strip 26, consisting of two pieces of abrasive coated material positioned adjacent one of the slots 24 in the center 20, ready to be entered into the slot. At the lower right a strip has been so entered. The projecting marginal portions thereof 28 at the inner end of the strip are folded back against the faces of the center 20, preferably without severance from the marginal portions further out. The parts are secured together by suitable adhesive. In this instance the parts 28 are bent over in opposite directions circumferentially of the disc as seen in Fig. 3. The distal end of the strip assumes a diagonal position as seen in Fig. 4. It lies substantially in a straight line and it is braced by gusset-like portions where the side edges are deflected to merge with the bent over parts 28, one gusset being in tension and the other in compression as the wheel rotates in a given direction. The projecting strips are in a sense closely arranged but nevertheless spaced and independent at their other ends. When the slots have been filled with fingers in this manner, sideplates 30, which may be of relatively thin and dense fibrous material in the nature of pressboard, are glued to the sides of the center 20 and project over the margins 28 of the strips. If the wheel is mounted on a shaft between end plates in the customary manner the end plates will press against the outer periphery of the center where the side portions of the strips 26 are folded down on the same and aid in holding the latter.

In the preferred form of the invention as used for polishing, the strips 26 are formed as shown in Fig. 5, consisting of two plies of fabric each coated on one side with abrasive granules, the two coated sides facing one another and the external sides of the plied strip carrying no grit. This arrangement doubtless seems somewhat paradoxical and the effect thereof will be explained later. Indeed, if the strips were very flexible and were bent over in operation, so that a flat surface of the strips engaged the work over an extended area, this arrangement would not be desirable. When the strips are disposed in diagonal slots as described, and the end portions folded down on the sides of the center in opposite directions, the outer extremity of the strip takes a diagonal position substantially straight as illustrated in Fig. 4, and, in polishing, the strip is only slightly bent in the circumferential direction, the work being done by the extreme ends of the strips.

While the element may be used alone and constitute

a wheel, a number of elements may be set side by side to form a wheel of wider face and, in this case, alternate elements may be reversed so that in successive elements axially of the assembly the ends of the strips incline in opposite directions. The ends of the strips then being wider than the hub, nest with one another in the manner illustrated in Fig. 6, which discloses diagrammatically the disposition of the end portions of three sets of strips 26a, 26b and 26c.

Further features of construction I believe may most readily be described by tracing a suitable method of production referring to Figs. 7-10. Abrasive coated sheet material and, in particular cloth based material, is manufactured originally in wide webs of indefinite length. For obvious commercial reasons a cloth of maximum width, as conveniently produced by the loom, is coated with a suitable adhesive to which the abrasive particles are applied. After partial setting of the adhesive the web is rolled up. From such a web commercial sheets and bands are cut. The fabric is usually a twilled fabric and the warps extend lengthwise of the web and the wefts or filling yarns crosswise. The fillings are usually smaller yarns and there are fewer of them to the inch. Thus a specific example is a twill of 2.59 yards per pound weight in a 40½-inch wide web and having a thread count of 96 threads per inch in the warp and 64 threads per inch in the filling. The setting of the adhesive is completed after the web is rolled up and the coated fabric has a more or less permanent curl corresponding to the bending along the warps to which it was subjected when rolled up. That is, the warps are curved. This curvature persists and frequently may be observed even in small pieces cut from the web. The coated side usually is convexed.

In Fig. 7 is shown a web W of abrasive coated fabric which is first slit along lines 40 in widths corresponding to the length of the fingers 26. Two such slit lengths or "tapes" T (I use the word "tapes" to avoid confusion with the word "strips" as applied to the parts 26 of the wheel otherwise referred to as fingers) may be superposed with their abrasive coated sides in contact and their edges in register and the edges are coated with a suitable adhesive such, for example, as a rubber latex, as here indicated diagrammatically by the showing of coating rolls 42. The adhesive is forced for a slight distance between the opposed faces of the webs and bridges over the exposed edges at 44. From the head of the two-ply tape, sections corresponding to the width of the fingers 26 are cut off as seen at the left of Fig. 6. It will be noted that the smaller and less numerous weft yarns are longitudinal to the strip 26 (radial in the wheel) and the warp yarns transverse. Because of the curl of the material the plies of the compound strip may be slightly bowed transversely, tending to gape a little along their longitudinal edges, as illustrated with some exaggeration in Fig. 9. In Fig. 4 the ends of the strips are shown flat without attempt to show the slight bowing which, as will appear, is believed to be significant.

The adhesive applied to the edges holds the two plies together for further handling. While the grit is faced inwardly for functional reasons in the completed wheel, the fact that the exterior surfaces of the strip are smooth facilitates the handling of them in the further assembly of the wheel, either by hand or by automatic machinery.

In Fig. 10 there is illustrated a jig by means of which the assembly of the wheel may be completed by hand but which embodies principles of design applicable to an automatic, power-driven mechanism. This comprises a base 50 with a projecting spindle 52 of a size corresponding to the shaft opening 22 in the finished article. One of the side plates 30 may be slipped over the spindle to rest on the base 50. A spacer 54, herein in the form of a spool, with a radial slot permitting it to be assembled or disassembled from the spindle from the side, rather than over the end, is next applied. This spool, herein has feet 56 to rest on base 50 outwardly of a side plate

30 resting on that base and a top head or supporting surface 58 on which a center disc 20 rests when assembled over the spindle. The diameter of the head 58 is somewhat less than the diameter at the base of the slots 24, and the slotted portion of the disc 20 extends radially past the head as illustrated at the left of Fig. 9. A strip 26 may have one of its cemented together ends 28 dipped in adhesive and is inserted in a slot 24 as shown at the right of Fig. 10. The ends are held together and are easy to line up with the slot and to push into the same. Herein the head 58 is shown as provided with a downwardly offset extension 60 to provide a support and gage for the inserted strips. The center disc may be turned with or independently of the spool and additional strips inserted until all the slots are filled.

Another end plate 30 as shown in dotted lines may be placed over the spindle and the spool 56 withdrawn. The opposed surfaces are suitably coated with adhesive and, on bringing together into contact the lower side plate 30, the center disc 20 and the upper side plate 30 shown in Fig. 10, the projecting side portions at the inner end of the strip will because of their diagonal disposition be folded over in opposite directions on the side of the disc 20, as illustrated in Fig. 3, and is desired. An initial adherence being thus secured, the wheel may be removed and subjected to a more powerful compression if desired, and finally cured. The outer cemented together end portions 44 of the strips 26 are trimmed off in truing up the wheel for use, leaving an open joint at this place.

In the earlier passage in this specification it has been stated that the disposition of the adhesive coated faces at the interior of the strip appeared somewhat paradoxical. The advantages arising from this arrangement are empirically demonstrated. The reasons are perhaps somewhat obscure and the following explanations are to a certain extent inferential, but agree with the results of practice. The action of the abrasive is at the ends of the strip by the granules there exposed or exposed by a very slight flexure of the strip to permit one face to slide beyond the other, or an almost imperceptible splay of the plies. The granules of abrasive wear away and are in part torn away from the supporting fabric. It is desired that this fabric should be worn away as it loses its grit. As the fabric wears threadbare the lighter and less numerous weft threads readily release the short transverse lengths of warp, themselves disintegrate and the end of the finger is renewed. If the threadbare fabric remained it would deleteriously affect the quality of the work, due to the fabric with the starch or other "finish" incorporated therein being dragged over the face of the work. Comparative tests have shown that the provision of the weaker and less numerous threads, the filling or weft threads in this instance, lengthwise of the finger, brings superior results as contrasted with the disposition of the heavier warp threads in that direction.

There is an open joint between the plies at the end of each strip but the plies do not however readily separate and splay apart. Comparative tests have shown that when the fingers are formed as described, with the lighter threads longitudinal, they appear to be stiffer than strips cut the other way of the fabric, and also stiffer than strips with the abrasive coated faces on the outside. It seems reasonable to attribute this to the slight bow or curl in the strips which strengthens them as against deflection. If convex surfaces face one another there may be some interlocking of the granules along the center line, but there are no large areas face to face, to scrub one against the other with resultant deterioration. Also no abrasive coated faces of one strip are presented to those of an adjacent strip to cause such scrubbing at points inward of the extremities if the two are forced into contact as the wheel turns and thereafter rebound. When the abrasive coated surfaces face one another as described there is little relative movement and no substantial loss by scrubbing.

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I am aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive, as is in fact clear in several matters from the description itself. Reference is to be had to the appended claims to indicate those principles of the invention exemplified by the particular embodiment described and which I desire to secure by Letters Patent.

I claim:

1. A polishing element comprising a central disc and a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger comprising at least one but not many strips of woven fabric with edges substantially parallel to the weave, the fabric having abrasive particles on a face thereof, the coated faces of the two plies being inward and presented one to the other.

2. A polishing element comprising a central disc and a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger consisting of two superposed plies of fabric each having a coating of abrasive particles on one face only thereof, the plies outwardly from the center having an inherent transverse curvature opposite in the two plies.

3. A polishing element comprising a central disc and a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger consisting of two superposed plies of fabric each having a coating of abrasive particles on one face only thereof, the coated faces of the two plies being inward and presented one to the other, the plies outwardly from the center having an inherent curvature transversely opposite in the two plies.

4. A polishing element comprising a central disc and a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger comprising at least one but not many strips of woven fabric with edges substantially parallel to the weave, the fabric having abrasive particles on a face thereof, the end edge of the strip extending transversely across the periphery of the center, the fabric having per unit of linear measure fewer threads lengthwise of the finger than transversely.

5. A polishing element comprising a central disc and

a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger comprising at least one but not many strips of woven fabric with edges substantially parallel to the weave, the fabric having abrasive particles on a face thereof, the end edge of the strip extending transversely across the periphery of the center, the threads of the fabric which extend lengthwise of the finger being smaller than those which extend transversely.

6. A polishing element comprising a central disc and a multiplicity of spaced fingers secured to the periphery of the disc at their inner ends, their outwardly extending portions being of a length greater than their width and disposed in planes substantially transverse to the disc, the fingers being self-sustaining in their radial positions but capable of bending when their outer ends move over a piece of work, each finger comprising at least one but not many strips of woven fabric with edges substantially parallel to the weave, the fabric having abrasive particles on a face thereof, the end edge of the strip extending transversely across the periphery of the center, the threads of the fabric which extend lengthwise of the finger being smaller than those which extend transversely and fewer in number per unit of linear measure.

7. A rotary abrading element comprising a board of agglomerated plies in the form of a disc formed for mounting on a rotary driver to turn about its center, the disc having a series of slots across its periphery diagonal to the axis of rotation and upstanding strips of flexible sheet material coated with abrasive granules adherent thereon, the width of the strips being substantially greater than the thickness of the disc, the strips having their inner end portions fitted into the slots, the margins of said end portions being folded in opposite directions on the end faces of the disc and secured thereto with the free outer portions of the strips projecting laterally beyond the planes of said faces of the disc.

8. An abrading element as set forth in claim 7 wherein the strips consist of two plies with the abrasive particles on their confronting faces only.

9. The method of constructing a buffing wheel of the kind described which comprises assembling in edge-aligned superposition two tapes of flexible material having abrasive particles on oppositely directed surfaces thereof uniting the edge portions only by adhesive, severing transversely from the plied tapes sections of restricted dimension lengthwise of the tape to provide plied strips united at their ends, anchoring one such end of each of a multiplicity of said strips in circumferential series in traversing relation to a central supporting disc and opening the joints between the plies at the outer ends.

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