Oct. 24, 1967 W. E. BECKER 3,348,256

CRENELATED POLISHING PAD

Filed May 25, 1965

Fig. 1.

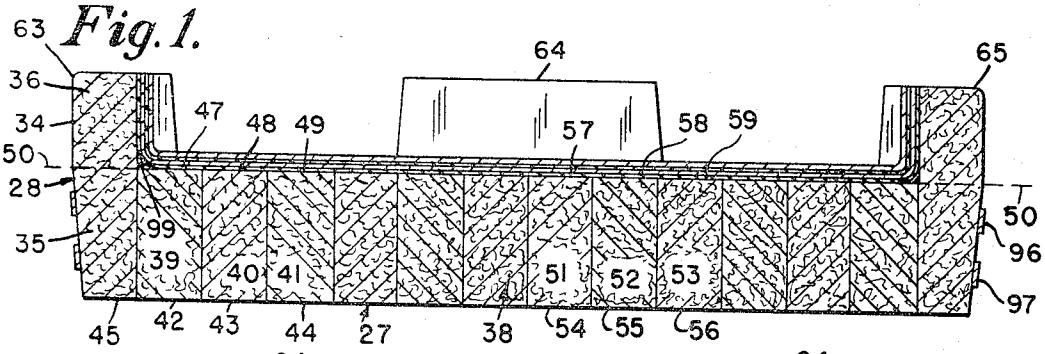


Fig. 2.

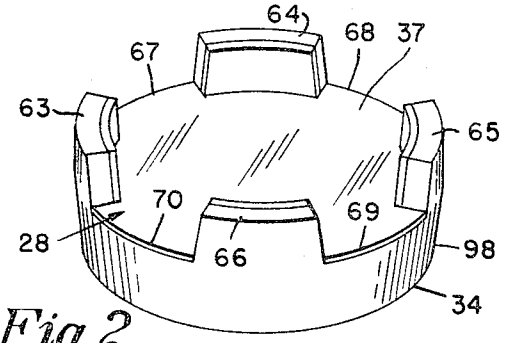


Fig. 3.

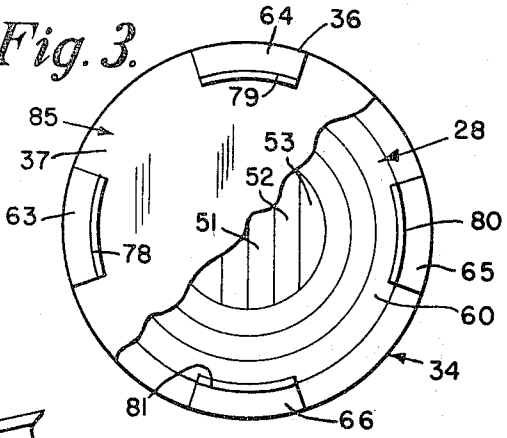


Fig. 4.

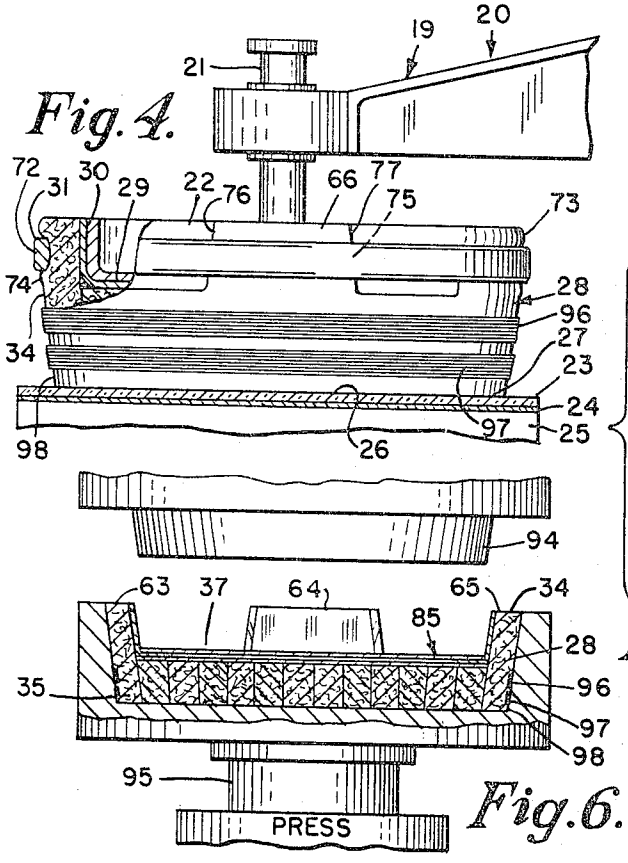


Fig. 5.

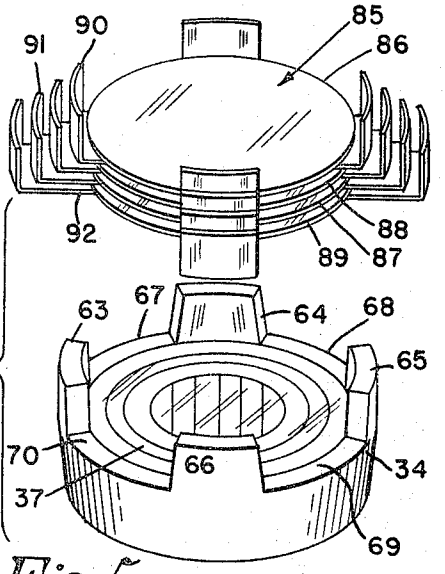


Fig. 6.

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CRENELATED POLISHING PAD

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ABSTRACT OF THE DISCLOSURE

A glass polishing pad of such thickness of felt as to be unbendable around a glass polishing block is provided with preformed crenelations of felt which form a recess for the block and permit the pad to be mechanically clamped on the block. The crenelated felt pad is unitized by reinforcing layers bonded to the felt. The crenelations are formed in an outside, generally cylindrical, ring of felt which surrounds a cylindrical disc of edgewise upstanding felt strips.

This invention relates to an improved mechanically held polishing member of the type used in polishing lateral surfaces of glass, marble, and other large plane hard surfaces and especially to such felt thickness as to be relatively unbendable.

In the flat glass industry mechanical-chemical operations, such as polishing, cleaning and washing, are performed on the surfaces of glass while it is being conveyed through the operation in either sheet form, or as a continuous ribbon.

In either case, the polishing or cleaning operation is accomplished by causing a plurality or rotating pad-covered polishing units to press against and slide over the glass surface. The pad face is saturated with the appropriate cleaning or polishing compounds and depending upon the operation it may be used either on the top, or the bottom, of the glass surface and in some cases simultaneously on both surfaces.

As the pad surfaces wear away, they must be replaced by attaching new pads to the polishing blocks. This attachment may consist of a mechanical holding device, or it may be accomplished by adhesively bonding the felt to the polishing block.

Traditionally, the polishing felts have been held mechanically by causing the four corners of a square felt to bend around the outer periphery of the circular metal polishing block for locking thereon by an outer locking ring or band, which is hydraulically pressed on to and over the upturned corners of the polishing felt. This method of holding felt in place has been widely accepted as a positive and practical procedure. However, it has the disadvantage that it is limited to felt of about one inch thickness, which necessitates frequent changes.

Other disadvantages of this type of mechanically held relatively thin, square, polishing felt, embodied in the pressed-on ring method, is that perfect alignment to the block and uniform tautness across the block are impossible to achieve. Unless the felt is relatively true on the block and has the proper tension, the possibility of cyclic fatigue or wedged wear exists.

The relatively thick, circular, adhesively secured polishing felts of the type described in my United States Patent No. 3,038,279, issued June 12, 1962, have not heretofore been adaptable to the conventional system of holding felt with a pressed-on steel ring.

The method of holding the polishing felt in place by adhesive attachment has been less widely accepted in that special care must be exercised in obtaining clean surfaces to which to apply the adhesive. Curing procedures must be closely supervised and properly conditioned cements must be employed. Special provisions must also be made to handle the cementing operation, whether it be of the hot melt or solvent release type, by way of adequately ventilated rooms adjacent to the polishing operation. In addition, the increasing demand of lower operating costs and higher speeds has resulted in the thermal failure of many adhesive bonds. There are no thickness limitations with adhesively held polishing felt.

I am aware that it has heretofore been proposed to provide a yieldable felt pad within an outer, relatively thin covering sheet, the sheet having a series of tongues therearound for bending to the shape of a polishing block. Buffing heads of this type are shown in United States Patents 505,644 to Perry of Sept. 26, 1893, United States Patent 528,024 to Perry of Oct. 23, 1894, United States Patent 631,675 to Rogers of Aug. 22, 1899, and United States Patent 736,736 to Kane of Aug. 18, 1903. However, in pads of this type the tongues are bent from a thin bendable sheet material for distortion to conform to the shape of the block and the felt, if any, is inside the sheet while in this invention the felt is relatively thick and on the outside of the reinforcing sheet with the felt tabs preformed without bending to conform to the shape of the block.

The principal object of this invention is to provide a relatively thick crenelated, composite, polishing pad of felt, the crenelated felt portion upstanding integrally around the upper periphery of the pad with its alternate solid felt intervals resiliently wedged under the locking ring and with the block engaging faces of the pad covered by a reinforcing backing.

A further object of this invention is to provide a composite polishing pad having preformed, upstanding, reinforced tabs of felt therearound for mechanical attachment to the polishing equipment with no modifications to the existing holding devices.

Another object of this invention is to provide a composite polishing pad, which may be held by existing mechanical equipment and which may be used in substantially greater thickness than heretofore possible.

A further object of the invention is to provide a relatively thick composite polishing pad, which eliminates the need for adhesive bonding, assures a more positive hold and allows greater stresses to be applied through the polishing pad.

Another object of the invention is to provide a polishing felt of substantial thickness formed of vertically disposed felt strips retained laterally by an annular felt ring, the ring having preformed, integral, felt tabs normally extending up the side of a steel polishing block to provide a resilient wedge between the block and a steel ring which has been pushed on hydraulically.

Still another object of the invention is to provide a polishing pad made up of vertically oriented felt segments held together by an outer felt ring having preformed, upstanding felt tabs therearound, by a rubber fabric backing extending over the entire back of the composite and reinforcing the holding tabs, which extend up between the steel block and steel ring, and by at least one compression band extending around the pad.

Still another object of the invention is to provide a relatively thick polishing pad, which may be applied without adhesive to the polishing block with uniform alignment and tension and which will operate with uniform and even polishing motions.

Additional objects and advantages of the method of making the composite polishing pad and the improved polishing member will be apparent from the claims, the description of the drawing, and from the drawing in which:

FIGURE 1 is a side elevation, in half section, of the crenelated, composite, polishing felt of the invention,

FIGURE 2 is a perspective view on a smaller scale of the felt shown in FIGURE 1,

FIGURE 3 is a plan view, with a portion of the backing broken away, of the felt shown in FIGURE 2,

FIGURE 4 is a fragmentary side elevation, with part broken away, showing the crenelated felt of the invention mounted on a polishing block,

FIGURE 5 is an exploded view, on a smaller scale, showing the doubled, crenelated, reinforcing backing and the crenelated felt ring and disc-shaped felt body, and

FIGURE 6 is a diagrammatic, fragmentary, side elevation showing the step of adhesively uniting the parts shown in FIGURE 5, into a unitized, crenelated felt polishing pad.

A main supporting arm **20** of a conventional glass polishing machine **19** is indicated in FIGURE 4, the arm **20** having a plurality of rotating, polishing spindles such as **21**, each carrying a circular polishing block such as **22**. In the plate glass industry, the glass sheet **23** is adhered by plaster **24** to a carriage **25**, the upper face **26** of the glass being polished by the polishing faces **27** of the felt polishing pads **28**. The polishing blocks **22** are usually of metal, with a flat, circular lower face **29** covered by the polishing felt and a smooth, cylindrical outer side wall, or peripheral rim, **30**. The conventional, relatively thin, square polishing felt, is not more than one inch thick so that its four corners can be bent upwardly to be locked in place by a locking ring **31**, hydraulically pressed over the felt corners and block. Felts of greater than one inch thicknness have heretofore not been mechanically attachable by a locking ring **31**, due to the stiffness and lack of bendability of a thick felt pad, and have therefore been thick, solid cylinders adhesively attached flatwise to the lower face **29** of the block.

The preformed, crenelated, composite polishing pad **28** of the invention, is of predetermined diameter and height, or thickness, to fit on the block **22** and to be mechanically attached thereto by the locking ring **31**.

Pad **28** includes the outer retaining, or attachment, ring **34**, of polishing felt, the ring **34** being generally cylindrical and having a hollow cylindrical lower wall portion **35** and an integral, interruped upper wall portion **36**, outlining a hollow cylinder and forming a recess **37** to receive the polishing block **22**.

The hollow, cylindrical, lower, wall portion **35**, encircles the main body **38** of pad **28**, the body **38** being disc, or solid cylindrical, in configuration and preferably formed of a plurality of strips of polishing felt, **39**, **40** or **41** each upstanding on its lower edge **42**, **43** or **44**, the latter forming part of the circular polishing face **27** of the pad and being coplanar with the lower, annular, polishing edge **45** of the outer ring **34**. The upper edges **47**, **48** or **49** of each strip **39**, **40** or **41**, and the top of the lower wall portion **35** of ring **34**, all terminate substantially in a common plane, central of ring **34**, and parallel to the plane of lower face **27**, the central plane being indicated by dotted line **50**. The strips **39**, **40** and **41** are preferably closed, annular rings of felt having a wall thickness corresponding to the wall thickness of ring **34** of about one inch but being substantially greater than one inch in height, for example from two to four inches. The outside diameter of the body **28** is substantially equal to the diameter of the block wall **30** so that the upper face of body **28** is substantially coextensive in area with the face **29** and the inside diameter of the upper wall **36** is substantially equal to that of wall **30** to closely fit therearound.

The endless, closed, individual felt rings **39**, **40** and **41** in the outer peripheral portion of body **38**, tend to prevent rupture of the pad from lateral polishing forces. Each is of progressively smaller diameter from the outside to the inner ring **41**. The inner ring **41** is preferably filled with juxtaposed, parallel, straight, edgewise-upstanding felt strips **51**, **52** or **53** to increase the spread of the slurry in a radial direction from the rotational axis to the outside of the pad. The lower polishing edges **54**, **55** and **56** are in the plane of the lower face **27**, all of the strips **39**, **40**, **41**, **51**, **52** and **53** are of uniform height and all of their upper edges **57**, **58** and **59** are in the central plane **50** to form a flat, circular, felt, upper face **60** on body **38** and in central plane **50**.

The continuous, annular, lower wall **35** of ring **34** circumferentially encircles the disc shaped main body **38**, and the upper wall **36** of ring **34** extends upwardly from the central plane **50** to the plane of the top of the outer wall **30** of block **22**. Upper wall **36** could be a continuous, upstanding, self-supporting, rim-like flange of polishing felt but preferably it is interrupted, or crenelated, to form at least four circumferentially spaced integral attachment tabs, **63**, **64**, **65** and **66**, one in each quadrant and each of less angular length than the length of one of the spaces **67**, **68**, **69** or **70** therebetween.

I use the term "crenelated" to mean a wall consisting of a series of alternate solid parts and open spaces, upstanding from, and extending around the upper, peripheral edge of a body, the solid wall parts being formed of the material of the body. It will be seen that the tabs **63**, **64**, **65** and **66** are preformed to be inherently upstanding around the edge of the pad **28**, without requiring upbending or distortion of the felt material and that the tabs are self-supporting, relatively thick and resiliently yieldable to slightly compress under the pressure exerted by the locking ring, as indicated at **72** in FIGURE 4. A corresponding bulge **73** or **74** occurs in the felt of the tabs, above and below the ring **31**, and each felt tab such as **66** also bulges as at **75** into the spaces **69** and **70** on each side thereof, this resilient wedging action serving to clamp the ring **31** more firmly in place.

Each tab, such as **66**, is preformed to be arcuate in plan thereby conforminng to the hollow, cylindrical shape of the wall **30** of block **22** and preferably the side edges **76** and **77** of each tab, such as **66**, are slightly beveled, or tapered. The inner felt faces of the tabs are designated **78**, **79**, **80** and **81**.

Reinforcing backing means **85** is provided as a covering over the upper face **60** of the body **38** and over the inner faces **78**, **79**, **80** and **81** of the upstanding felt tabs to unitize the pad **28**, while protecting the block **22** from the slurry. Means **85** is preferably a doubled layer of heavy canvas duck **86** and **87** adhesively united to a doubled layer of cured rubber **88** and **89**, the cured rubber bonding the duck layers together and bonding the doubled backing to the felt body and tabs. As shown in FIGURE 5, the plurality of reinforcing layers **86**, **87**, **88** and **89** are preferably in the form of four superposed flat discs of sheet material alternately of partially cured rubber and canvas duck, the tab portions being separate patches such as **90**, each extending upwardly as at **91** and each having a base portion **92** interleaved between the disc layers.

As shown in FIGURE 6 the crenelated, felt pad **28** is fabricated by first forming the closed, annular ring **34**, of felt, in a diameter to fit around the side wall of the block **22** and then cutting, or otherwise forming, at least two and preferably four, tabs **63**, **64**, **65** and **66** in the upper portion. The lower, continuous wall portion **35**, of ring **34**, is then filled with juxtaposed strips of felt upstanding on the lower edge and preferably forming concentric rings in the outer periphery and straight strips in the central portion. The reinforcing backing means **85** is then placed within the recess **37**, of the crenelated felt pad, to form a crenelated backing therefor, overlying the upper edges of the felt strips and the inner faces of the felt tabs. The assembly is then placed between the hydraulic press platens **94** and **95**, which are steam heated, and subjected to pressure

of about 50 p.s.i. at a temperature of about 230° F. for about thirty minutes. The partially cured rubber layers, thus are completely cured while permanently bonding all of the layers of canvas, rubber and felt into a unitary, composite, preformed crenelated polishing pad of substantial thickness.

At least one, and preferably two, compression bands **96** and **97**, extend circumferentially around the outside face **98** of the lower wall portion **35**, the bands being about three quarters of an inch in width and the lower band being spaced about three quarters of an inch above the plane of the lower polishing face **27**. Bands **96** and **97**, in cooperation with the concentric rings of felt of the pad tend to support the pad against undue lateral displacement during the polishing operation. The band **96** in the upper section, and the band **97** in the lower section, of lower wall **35**, exert sufficient inward force to permanently compress the lower wall **35** into truncated conical configuration. Preferably the compression bands are wrapped around the ring **34** prior to placement of the assembly into the press for curing, and they may be of any soft, strong material such as reinforced rubber or the like. Bands **96** and **97** may advantageously be made of five cords of viscose rayon cemented together by a suitable adhesive, the heat and pressure of molding tending to melt some of the cement holding the cords together, thereby causing some adhesion to the felt surface of ring **34**.

As best shown in FIGURE 1, an elongated filler strip **99**, of uncured rubber, may be inserted along the corner between the inner face of each felt tab and the upper face of the body **38** to round off the bend in the backing means **85**, at this location and thereby add resistance to pad fracture.

In any case, the rounded edge of the mold head **94** and the resiliency of the felt fabric and rubber tend to form a fillet, in the area occupied by strip **99**, if no such strip is used, thus producing a concave junction between the meeting surfaces.

I claim:

1. A preformed composite polishing pad for attachment to a glass machine polishing block having a peripheral exterior rim of predetermined height and diameter, said pad comprising:

a hollow attachment ring of polishing felt, said ring having a lower wall portion upstanding from the plane of a lower, annular polishing edge to a central plane, parallel thereto and at a height thereabove of substantially greater than one inch and an integral, unitary, upper, wall portion, defining a hollow cylinder of predetermined height and diameter terminating in a plane substantially above the planes of said lower wall portion and having an inner face adapted to be coplanar with, receive and encircle the rim of said block;

a disc-shaped body of polishing felt filling the space within the lower wall portion of said attachment ring, said body having a lower, circular polishing face coplanar with the lower polishing edge of said ring and and an upper face in the central plane of said ring;

a unitary, cured rubber and fabric backing covering, and adhesively united to, the upper face of said disc-shaped body and to the inner face of the upper wall portion of said ring, and

at least one compression band, extending entirely around the outside face of the lower wall portion of said ring, at a spaced distance above the plane of the lower polishing face, of said body for supporting the felt thereof against lateral displacement.

2. A composite polishing pad as specified in claim **1** wherein:

said disc shaped body of polishing felt is formed of a plurality of juxtaposed felt strips, each upstanding on a lower edge coplanar with the lower polishing face thereof, and each of uniform height above said face.

3. A composite polishing pad as specified in claim **1** wherein:

said disc shaped body of polishing felt is formed of a plurality of individual, endless, rings of felt in the outer peripheral portion thereof, each concentric with said felt attachment ring and of progressively smaller diameter from said attachment ring to an inner ring and said inner ring is filled with a plurality of straight, parallel strips of felt each upstanding on the lower edge thereof;

whereby said rings offer resistance to lateral displacement of said pad during polishing and said straight strips offer assistance to the spread of slurry during polishing.

4. A composite polishing pad as specified in claim **1** wherein:

the upper wall portion of said retaining ring comprises four, circumferentially spaced, upstanding tabs, one in each quadrant therearound and each of arcuate section in plan, said tabs defining a hollow cylinder and being compressible into the spaces between the tabs under the pressure of the locking ring of said polishing block.

5. A composite polishing pad as specified in claim **1** wherein:

said unitary cured, rubber and fabric backing comprises a plurality of alternate layers of cured rubber sheeting and heavy, closely woven, canvas adhesively united to each other and to a filler strip of rubber extending around the periphery of the upper face of said body proximate the central portion of the inner face of said felt retaining ring to conform said pad to the curved edge of the rim of said block.

6. A composite polishing pad as specified in claim **1** wherein:

said body is several inches in thickness and there are two said compression bands, one in the upper section and one in the lower section of the lower portion of the wall of said retaining ring, said lower band compressing said pad into truncated conical configuration.

7. A preformed, composite, polishing pad for a glass polishing block said pad comprising:

a relatively thick disc-shaped body of polishing felt, said body having a flat, lower polishing face and an opposite upper face, in a plane at a spaced distance above said lower face, said faces being substantially coextensive in area with said block;

an outer attachment ring of felt, said ring having a hollow cylindrical lower wall coplanar with, and circumferentially encircling said disc-shaped body and having at least two oppositely disposed, felt, attachment tabs integral with said wall and inherently upstanding therefrom to a plane at a spaced distance above the plane of said upper face of said body, said tabs being preformed with an arcuate section in plan;

at least one unitary reinforcing layer of cured rubber and fabric covering the inside face of said tabs and covering the upper face of said body,

and at least one compression band extending circumferentially around the outside of the lower wall of said ring, at a spaced distance above the lower face of said pad, for resisting lateral forces on said pad.

8. A composite polishing pad for a glass polishing block, said pad comprising:

a cylindrical body of polishing felt substantially coextensive in area with the face of said block and of a thickness substantially greater than one inch;

a continuous hollow cylindrical ring of relatively thick polishing felt extending peripherally around said body and encircling said body, said ring having a plurality of preformed self-supporting, spaced-apart, tabs of said felt, integral with said ring and extending upwardly therefrom to define a block receiving recess with said body;

a reinforcing, fabric layer lining the inner face of said recess and adhesively united to said tabs and body,

and compression band means unitizing the felt of said ring and body for resisting lateral forces on said pad.

9. In combination:

a circular glass polishing block;

a composite polishing pad, of felt substantially greater than one inch in thickness, covering the polishing face of said block;

a felt ring encircling said pad, said ring having a preformed, upstanding interrupted, self supporting, integral rim-like flange of said felt, said interrupted felt flange extending around the peripheral wall of said block to form spaced attachment tabs of felt;

reinforcing means for unitizing the felt of said ring, tabs and pad, and

a locking ring encircling said felt attachment tabs on said block for firmly securing said pad thereon.

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