June 12, 1962 W. E. BECKER 3,038,279

COMPOSITE POLISHING PAD AND METHOD FOR MAKING SAME

Filed Aug. 17, 1960 2 Sheets-Sheet 1

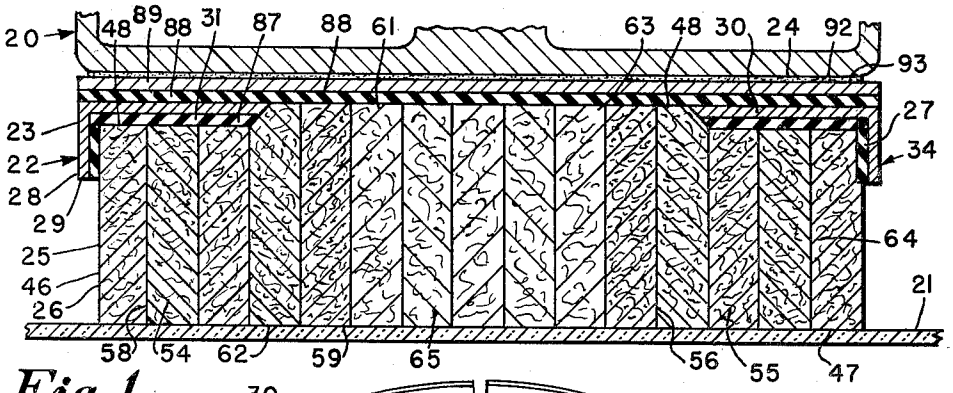



Fig. 1.

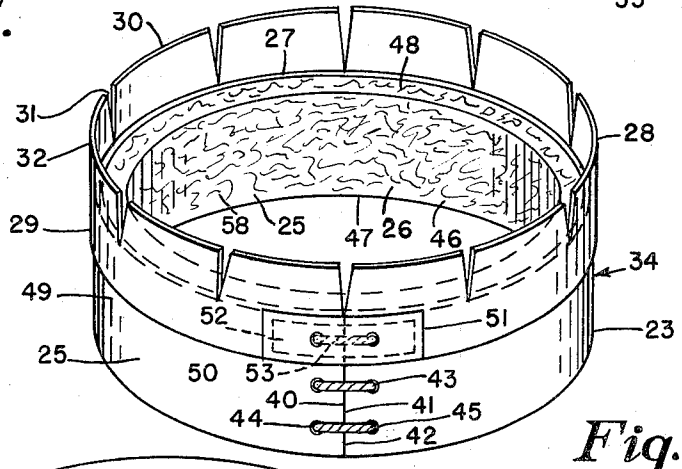



Fig. 2.

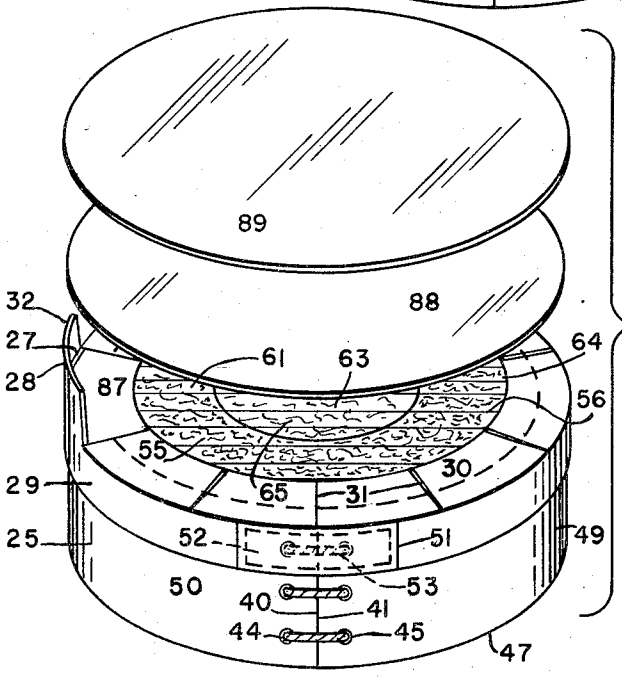



Fig. 3.

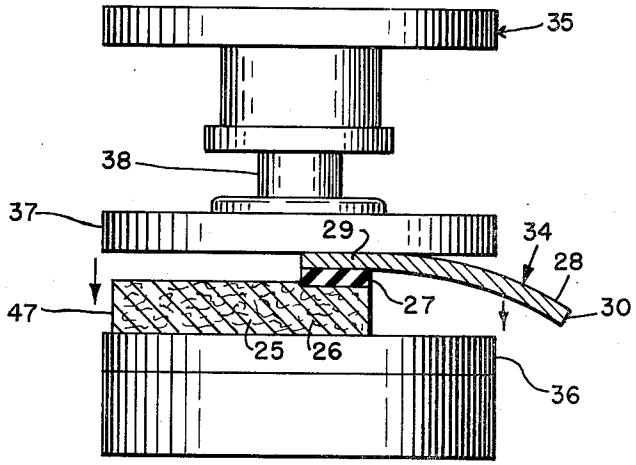
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COMPOSITE POLISHING PAD AND METHOD FOR MAKING SAME

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*Fig. 4.*



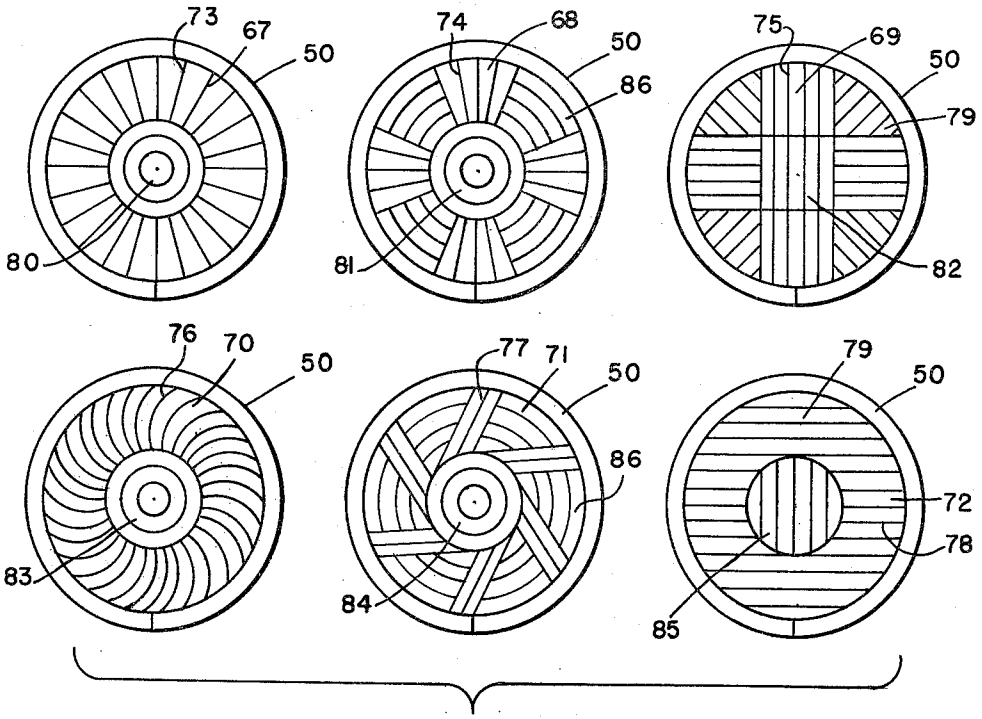




*Fig. 5.*

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# 3,038,279
# COMPOSITE POLISHING PAD AND METHOD FOR MAKING SAME

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13 Claims. (Cl. 51—195)

This invention relates to an improved polishing pad of the type used in polishing the surface of plate glass, marble or other large plane surfaces.

It is common in the manufacture of plate glass to position the individual glass sheets, pre-cut to convenient size, on a flat bed conveyor system, which transports the glass under successive grinding discs and, thence, under successive clusters of polishing felt blocks all of which rotate in a horizontal plane on and over the glass surface. More recent methods provide for simultaneously grinding and polishing both surfaces, in which case the sheet, or ribbon, is transported between the horizontally rotating grinding and polishing units, one set of which operates in an inverted position. The media used in the grinding operation is a slurry of graded sand and other abrasive particles, while the media used in the polishing operation usually consists of a slurry of graded iron oxide particles. The comparative particle size of the two operations is in the order of thirty to one.

The glass after grinding exhibits a plane but relatively rough surface, which is particularly abrasive and wearing to the polishing surface of the conventional, horizontally-disposed polishing felt. As the plate glass enters the polishing zone its relative coarseness causes severe felt wear at the initial polishing positions, while further wear on the successive polishing blocks is directly proportional to the increasing smoothness of the plate glass, the speed of operation, the lubricity of the polishing slurry and the degree of down pressure.

The conventional polishing felt, now much used in the industry, is horizontally disposed across the face of a circular polishing block, the felt being square with its corners turned up and held in place by a metal retaining ring encircling the block, or being round and secured in position by adhesive bonding. It has also been proposed, as in U.S. Patent No. 1,147,593 to Christine of May 30, 1922, to provide a polishing pad formed of vertically-disposed felt strips, coiled within a detachable metal ring, the metal ring encircling the felt coil. In my co-pending application, Serial Number 794,008, filed February 18, 1959 and entitled "Composite Polishing Member and Method for Making Same," a horizontally disposed polishing felt is disclosed which is backed by a strong fabric adhesively united to the felt by cured rubber, the polishing block being thus shielded from the slurry and the felt prevented from fatigue rupture at or near the turned up corners thereof.

The object of this invention is to provide a composite polishing pad for adhesive attachment to the blocks in the initial section of the polishing zone which will more effectively withstand the abrasive action of freshly ground plate glass surfaces.

Another object of the invention is to provide a composite polishing pad with vertically oriented polishing felt strips united by means of a reinforcing rubber and fabric



backing which will facilitate convenient adhesive bonding to the polishing blocks while maintaining the felt strips in vertical position.

A further object of the invention is to provide a polishing pad formed of upstanding, juxtaposed, felt strips of uniform cross section, with vertical passages therebetween extending continuously from the interior of the pad to the periphery, the felts being uncompressed laterally whereby the passages facilitate uniform and rapid distribution of slurry over the working face of the pad, when the pad is rotating in upright or inverted position.

Still another object of the invention is to provide a composite polishing pad having vertically disposed strips with passages therebetween which can be prefabricated in a variety of spoke-like patterns to give freedom of choice of polishing face designs, configurations and densities.

A still further object of the invention is to provide a composite polishing pad wherein the fibres are oriented normal to the glass surface and wherein the only material below the plane of the face of the metal polishing block is of a relatively soft nature such as felt, rubber and canvas whereby no metal can possibly touch the glass regardless of wear.

Another object of the invention is to provide a polishing felt made up of vertically disposed felt strips, retained laterally by an annular felt ring and an annular fabric band around the upper portion of the ring, there being no hard material in the plane of the pad.

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

FIG. 1 is an elevation, in section through the centre, of a composite polishing pad constructed in accordance with the invention.

FIG. 2 is a perspective view showing the preferred method of forming the annular felt retaining ring and annular reinforcing band of the invention.

FIG. 3 is a diagrammatic view similar to FIG. 2 showing the preferred method of assembling the reinforcing backing disc, semi-cured rubber disc, reinforcing band, semi-cured rubber ring, felt retaining ring and felt filler strips just prior to curing of the rubber to form a unitary, composite pad.

FIG. 4 is a diagrammatic view, typical of the adhesive uniting of the parts of the composite polishing pad by pressing, heating and curing of the semi-cured rubber layers, the three plys of the member of FIG. 2 being shown pre-cut to predetermine dimensions and juxtaposed.

FIG. 5 is a diagrammatic bottom view, on a smaller scale, showing six different designs for the vertically disposed strips within the felt ring, each of which includes continuous passages leading from the interior of the pad to the periphery thereof.

As shown in FIG. 1, a plate glass polishing machine conventionally includes a plurality of polishing blocks such as 20, mounted for free rotation over a moving sheet of plate glass 21 on the arms of a power driven spindle, not shown. The ground glass 21, to be polished by the felt on the polishing block 20, has a relatively rough surface when first entering the polishing machine. This

roughness causes severe abrasion to the ordinary polishing felts, which first come in contact with the rough surface. As a result of this severe felt wear, costs of operation are relatively high in the initial phases of the polishing line. The danger of the felt wearing down to a level where parts of the block can damage the glass is also higher in this initial polishing phase. In addition to high material costs, the required frequency of replacement of worn polishing pads, of conventional type, results in higher labor costs.

In this invention, the composite polishing pad 22 is especially useful in the initial phases of the glass polishing line and has been found to provide longer life, better polishing and better distribution of the slurry, whether upright or inverted. As shown, in FIG. 4 the first step in producing the pad 22 is the provision of a retaining ring 23, of polishing felt, having a periphery which corresponds to the periphery of the block 20 and enclosing an area substantially equal to the area of the face 24 of the block 20. It is possible to make a closed, continuous ring of felt with no split or seam, by known means. However, from a manufacturing point of view it is more advantageous to form the ring 23 from an elongated strip 25, of polishing felt, of uniform rectangular cross section, the strip 25 consisting of compacted interlocked fibres 26 which have been conventionally felted. The strip 25 is preferably about eighty to one hundred twenty inches in length, one to three inches in thickness and three to four inches in height in order to provide long life and the best economy in operation. The dimensions of the strip 25 will of course be dependent on the area and configuration of the particular size polishing block upon which it is to be mounted and its length will be equal to the length of the periphery of the block with the other dimensions conforming thereto.

An elongated strip 27 of semi-cured rubber, of about .03 to .05 inch in thickness, about one fourth the width of the strip 25 and equal in length thereto is overlaid on strip 25. The semi-cured rubber strip 27 may be of the type commercially available as stock No. 50 of New Jersey Rubber Company of Taunton, Massachusetts. An elongated strip 28, of strong backing fabric is then overlaid on strip 27, as shown in FIG. 4, the strip 28 having what I call the band portion 29, uncut and continuous, and the remaining portion 30, cut laterally as at 31, to form a plurality of tongues 32. The tongue portion 30 overhangs the felt strip 25 and the rubber strip 27, and it may be desirable, although not shown, to cover the band portion 29 with another strip of semi-cured rubber, identical with strip 27, to enhance the chemical stability of the composite strip 34.

The layers 25, 27 and 28 are formed into an integral, composite strip 34 by means of heat and pressure in a suitable press 35. The press 35 includes the heated platform 36, heated head 37, and fluid actuated piston 38 and applies pressure of about fifty pounds per square inch at a temperature of about 230° F. for about thirty minutes to complete the curing of the rubber strip 27 while adhesively uniting the band portion 29 of the backing strip 28 to the felt strip 25. The backing strip 28 may be canvas, woven metal cloth or the like, and the fibre composition may be cotton, jute, ramie, rayon or nylon, but preferably the strip 28 is woven of acid resistant fibres such as wool, glass, "Dynel," "Orlon" or "Dacron."

The unitary, composite, laminated strip 34 is then formed into annular, closed configuration conforming to the periphery of a polishing block, which is usually circular. However, it will be understood that such shapes as squares, triangles, rectangles, ellipses and many others are possible if desired. The joining of the opposite ends 40 and 41 of the strip 34, to close the split, or seam, 42 is accomplished by lacing a cord, or twine, 43 of acid resistant material such as "Orlon" through four or six equally spaced holes 44 and 45 drilled about one inch



inward from each end. In addition to the chemical resistance of the cord 43, it should have relatively soft texture properties in order to prevent possible damage to the glass sheet 21 as the polishing pad wears down and through the lacings. The composite, laminated strip 34, as shown in FIG. 2, is thus in hollow, cylindrical form with a vertical felt wall 46 upstanding from a lower edge 47 and having an upper edge 48. The upper one fourth of the outside face 49 of the annular felt strip 25 is reinforced by the band 29 of fabric and the tongues 32 are in upward extension of the band 29. To further strengthen the felt retaining ring 50, a tab 51 of backing fabric such as 28, is overlaid on a semi-cured rubber tab 52, and both tabs are overlaid on the band 29 to close the split 42, the tabs being adhesively united to the band in the press 35, in the manner described above. Each tab may be about one and one quarter inches high and six inches long and the tabs may cover and encapsulate the top lacing 53 as shown.

The next step is the filling of the outer retaining ring 50 of polishing felt with pieces, or sections, of pre-cut and preformed filler strips of polishing felt. The fibres 26 of ring 50, and the fibres 54 of the filler strips 55 are preferably oriented so that a majority of fibres are either parallel, or perpendicular to the glass sheet 21. Longer felt wear has been realized when the fibres are normal to the sheet 21, as shown in FIG. 1, however, the quality of polish may be adversely affected with generally perpendicular fibres, when used near the end of the polishing line. The filler strips 55, can be circumferentially arranged, in relatively small lengths or a single strip could be coiled and upstanding on one edge as shown in the above mentioned Christine Patent, No. 1,417,593. However, to secure better distribution of the liquid slurry, especially when the composite pad of this invention is inverted and operating on the underface of a glass sheet 21, barriers to outward flow have been avoided. Instead, the filler strips 55 are preferably juxtaposed, and closely packed within the ring 50, to provide passages 56 therebetween which are continuous and lead from the interior of the pad as at 63 outwardly to the inner periphery 58 of the ring 50.

In FIGURES 1 and 3 the filler strips 55 are each of uniform cross section and extend in parallelism across the ring 50, each strip, or layer, upstanding vertically from one edge 59 and having its opposite edge 61 generally in the horizontal plane which is common to the upper edge 48 of ring 50. The lower edges 59 of the strips 55 form a polishing face 62 with the lower edge 47 of ring 50. In FIG. 1 the thickness of the rubber and fabric is much enlarged for clarity.

The central portion 63, of the strips 55, in operation, tends to become more hard than the outer peripheral portion 64 after extended use in polishing glass. It is, therefore, desirable in glass polishing that, regardless of the pattern, or design, of the filler strips 55, the central portion 63 be formed of low density felt strips such as 65, the central portion 63 preferably being about eight inches in diameter. It may be possible to reduce the tendency of the central portion 63 to harden by a looser packing of the filler strips 55 or by some of the patterns shown in FIGURE 5, but the best results have been secured by the use of lower density felt in the central portion 63. For example, when the peripheral portion 64 of the strips 55 is at a specific gravity of 0.60, the strips 65 in the central portion 63 are preferably at a specific gravity of 0.45.

In FIGURE 5, six of the many other designs, or patterns, of polishing faces possible in the composite polishing pad of this invention are illustrated. It will be understood that the most desirable and efficient polishing face design will be dependent on the physical and operating characteristics of each individual polishing line and that the method and pad of the invention lend themselves to satisfying the requirements of each user. In each of the

six designs, there is an outer retaining ring **50**, peripheral filler strips such as **67**, **68**, **69**, **70**, **71** and **72**, corresponding to strips **55**, and defining continuous passages **73**, **74**, **75**, **76**, **77** and **78** therebetween which lead out to the periphery. Lower density filler strips, corresponding to the lower density strips **65** are provided in the central portion of each design at **80**, **81**, **82**, **83**, **84** and **85**, and circumferentially extending strips such as **86** may also be used in the designs but, in general, all of the designs tend toward the radial rather than the circumferential. Strips which are not radial or circumferential, as at **79**, are also used to fill out the various designs.

When the ring **50** has been filled with the desired pattern of filler strips, each preferably equal in height to the height of the wall **46** and of the desired thickness and length, the final bonding operation takes place. A semi-cured rubber ring **87** is overlaid on the upper edge **48** of felt ring **50** and on the outer, upper edges **61** of the filler strips **55** and the tongues **32** of the fabric ring **28** are folded inwardly to overlie the ring **87**, and partially overlie each other as illustrated in FIG. 3. A semi-cured rubber disc **88** is then overlaid on the infolded tongues **32** and a fabric disc **89** is overlaid on disc **88**. The elements **87** and **88** are of the same material as the strip **27** and the disc **89** is of the same material as the strip **28**. The ring **87** and the central portion of disc **88** are in engagement with the upper edges **61** of all of the filler strips. The entire assembly is then placed in the press **35** and subjected to the same pressure and heat for the same length of time, as specified above, to adhesively unite all of the parts into a composite polishing pad **22**. The final curing of the rubber not only bonds all of the parts together, but the rubber forms a barrier which prevents any corrosive slurry from reaching the polishing block. The pad **22**, with the polishing face design of the user's choice is adhesively bonded to the face **92** of a polishing block **20** by a layer of adhesive **93** in a manner well known in the trade, for example by means of B. F. Goodrich Vulcalock Rubber Cement.

The band **29** of fabric and rubber on the outside of the pad **22** not only helps to hold the pad together but also serves as a useful gauge to determine the useful wear remaining in the felt. By replacing the felt, when it has worn down to the band, there is no possibility of the block face **92** touching the glass.

I claim:

1. A composite polishing pad for a polishing block of glass polishing machines and the like, said pad comprising a plurality of juxtaposed layers of polishing felt, upstanding on one edge to form a polishing face, substantially equal in area to the area of said polishing block, and having the opposite edges of said layers in a common horizontal plane, a retaining ring, formed of a single layer of polishing felt of uniform thickness, extending entirely around said juxtaposed layers, the lower edge of said ring forming part of said polishing face and the upper edge thereof being in said common horizontal plane, backing sheet means extending over the upper edges of said layers and ring, said means including an integral peripheral band downturned around the upper exterior portion of said ring, and terminating at a predetermined height above the lower edge of said ring and adhesive means adhesively uniting the upper edges of said layers and ring to said backing means and adhesively uniting the said downturned band to the upper exterior of said ring.

2. A composite polishing pad as specified in claim 1 wherein said retaining ring is split and the split is closed by a series of vertically spaced, horizontally extending lacings, each adapted to fall out when the said pad is worn down thereto.

3. A composite polishing pad as specified in claim 1 wherein said backing means is formed by an annular fabric element with an unslotted exterior periphery forming said band, a radially slotted interior periphery forming partially overlapping tongues, a circular fabric element overlying said tongues and cured rubber layers adhesively uniting said tongues and band to said felts and said tongues and felts to said circular fabric element.



4. A composite polishing pad as specified in claim 1 wherein said layers of felt are of random thickness and length and juxtaposed to define upstanding, continuous, passages therebetween, extending from the inner portion to the peripheral portion of said pad for the reception and centrifugal distribution of liquid slurry.

5. A composite polishing pad as specified in claim 1 wherein said layers of felt are of a predetermined density in the peripheral area of said polishing face and of a substantially lower density than said predetermined density, in the central area of said polishing face.

6. A composite polishing pad as specified in claim 1 wherein said layers of felt are of a different density in the central portion of said polishing face from the density of the layers of felt in the peripheral portion of said polishing face.

7. A composite polishing pad for use in a polishing machine, said pad comprising an outer retaining ring of polishing felt; a plurality of filler strips, formed of said polishing felt, juxtaposed within said ring, said strips and ring forming a polishing face and an opposite face; a reinforcing backing extending over said opposite face, said backing having a downturned peripheral band terminating part way down the exterior face of said ring and bonding means adhesively uniting said backing band to said ring and said strips for forming a single, unitary pad adapted to be adhesively bonded to a polishing block.

8. A composite polishing pad for use in a polishing machine, said pad comprising an outer retaining ring of felt, said ring being of uniform cross section therearound; a plurality of individual, upstanding, fillers of felt closely packed within said ring, the exposed lower edges of said ring and fillers forming a polishing face; unitary, reinforcing, flexible backing means covering the upper edges of said ring and fillers and including a downturned peripheral band extending around the upper portion of the exterior of said ring and cured rubber bonding means adhesively uniting said backing means to said felt ring and said felt fillers.

9. A composite polishing pad comprising a hollow cylindrical retaining ring of polishing felt, said ring having a wall of uniform height upstanding from a lower, annular polishing edge, at least one strip of polishing felt, equal in height with said wall and upstanding from a lower polishing edge, said strip being closely packed within said ring and filling the hollow therein to present a continuous, lower, polishing face with said ring and a cured rubber and fabric backing adhesively united to the upper edges of said ring and strip, said backing having an integral, downturned, retaining and gauge band extending entirely around the upper portion of the outside of said ring.

10. A composite polishing pad for adhesive attachment to a polishing block of a glass polishing machine, said pad comprising a plurality of juxtaposed, upstanding strips of polishing felt confined into a closely packed unit by an upstanding, annular, closed, outside strip of said polishing felt, said unit having a continuous upper face bonded to a cured rubber and fabric backing and having a continuous, lower polishing face, the felt in the central portion of said polishing face being of less density than the felt in the peripheral portion of said polishing face.

11. A composite polishing pad comprising a plurality of vertically disposed, closely packed strips of polishing felt enclosed within an annular, vertically disposed strip of said felt, a horizontally disposed, fabric backing sheet adhesively united to the upper edges of said strips and an annular, vertically disposed fabric, retaining band, of less height than the height of said strips, adhesively united to the upper portion of the outside face of said annular felt strip.

12. A method for making a composite polishing pad for glass polishing machines, said method comprising the steps of forming a closed ring of polishing felt; then adhesively uniting a closed annular band of fabric backing to the upper, outer periphery of said ring; then filling the said polishing felt ring with vertically disposed, juxtaposed strips of polishing felt and then adhesively uniting the upper edges of said ring, strips and band to a backing sheet for forming a unitary polishing pad.

13. A composite polishing pad comprising a plurality of vertically disposed, closely packed strips of polishing felt enclosed within an annular, vertically disposed strip of said polishing felt, a horizontally disposed fabric backing sheet adhesively united to the upper edges of said strips and an annular, vertically disposed, fabric, retaining band, of less height than the height of said strips, extending around the upper portion of the outside face of said annular felt strip.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,417,593 | Christine | May 30, 1922 |
| 2,311,135 | Steinmetz et al. | Feb. 16, 1943 |
| 2,366,877 | Schlegel | Jan. 9, 1945 |