Dec. 19, 1961 W. E. BECKER 3,013,366

COMPOSITE POLISHING MEMBER AND METHOD FOR MAKING SAME

Filed Feb. 18, 1959

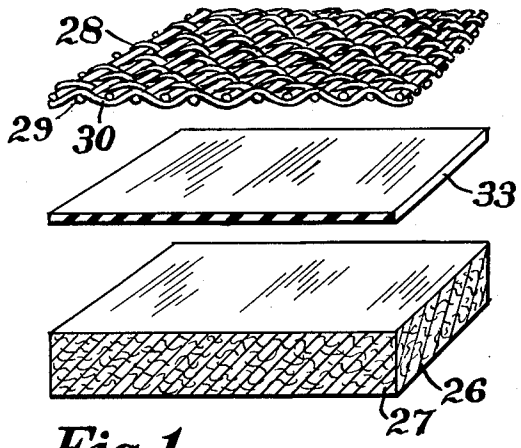


Fig. 1.

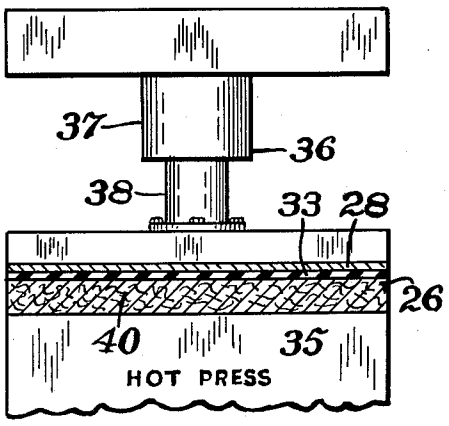


Fig. 2.

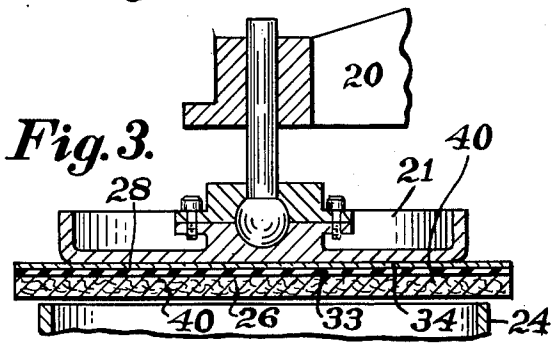


Fig. 3.

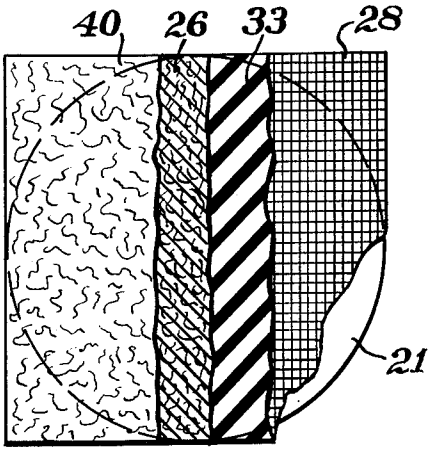


Fig. 5.

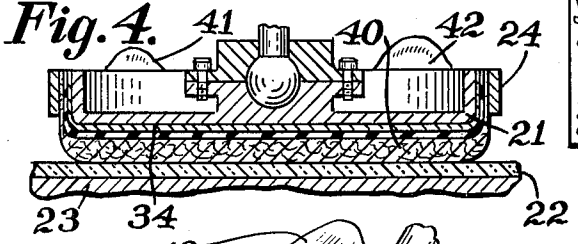


Fig. 4.

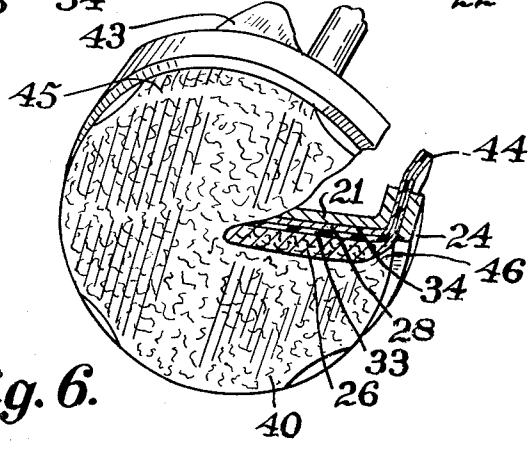


Fig. 6.

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COMPOSITE POLISHING MEMBER AND METHOD FOR MAKING SAME

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12 Claims. (Cl. 51—195)

This invention relates to polishing pads of felt, or the like, used in polishing the surfaces of plate glass during the fabrication thereof.

It has long been customary in the plate glass art to advance the glass to be polished along a path on moving tables, the glass passing under successive clusters of rotatable polishing blocks rotating in a horizontal plane. Each polishing block is of circular outline and faced with a detachable polishing pad of felt. The felt pads may be of circular outline and merely cemented to the polishing block but, more often, they are of square outline with the corners bent up around the block and clamped in place by a clamping ring.

Whether cemented to the block or ring clamped thereon, the polishing felt is continuously subjected to lateral, intermittent stress during the polishing operation which ultimately causes cyclic fatigue failure. It will be understood that the spider supporting the blocks is continuously rotating under power, the glass is continuously advancing with linear motion and the polishing felts are continuously freely rotating on their axes to produce severe cyclic stressing. Especially in the ring clamped pads, where the corners are bent at near right angles, the pad tends to rupture at the outer circular periphery and must then be replaced by a new pad even if there is substantial thickness left in the pad. Otherwise, continued use would involve the liability of presenting the unpadded polishing block to the face of the plate glass with the resultant severe damage to the glass.

In additon to the cyclic stress encountered by a polishing felt in a glass polishing machine, the pad is also subjected to continual saturation. In the course of the polishing operation, the pads carry and distribute the polishing slurry to the glass and become saturated with the slurry moisture. This moisture and the heat generated by friction causes the physical properties of the felt to become altered and in the case of felts merely cemented to the block may adversely affect the cement bond or the block itself. The slurry may consist of polishing rouge in the form of iron oxide, iron sulfate or other chemicals or fine abrasives which tend to have a degrading effect on the felt especially in combination with the continual lateral forces acting upon the felt.

The normal practice of clamping a polishing pad to a circular, cast iron, polishing block is to force a steel ring over the resilient polishing pad thereby squeezing the pad between the ring and the polishing block. By means of a special hydraulic press the ring is pushed over the polishing pad and is securely held in place by the fact that the pad is slightly resilient and facilitates a press fit.

The polishing pad can be circular in shape to accommodate the circular block, or can, for the sake of economy of material, be square in outline with only the four corners secured to the block by the ring. Because of the stiffness of the polishing pad and the clamping ring forcing a 90° bend around the periphery, or across the corners, as the case may be, there is an approximate one inch thickness limitation to the polishing pad. This limitation dictates that complete wear through the thickness be realized as maximum efficiency can only be obtained by both complete utilization of the polishing pad and the minimum number of polishing pad changes.

It is the object of this invention to provide an improved

polishing member for attachment to a circular polishing block wherein the felt polishing pad is backed by a strong, woven fabric to prevent rupture of the felt and the fabric is isolated from the pad by sheet rubber to prevent deterioration of the fabric by the harmful effects of the polishing slurry.

Another object of the invention is to provide a composite polishing member faced with felt and backed by closely woven strong fabric, the felt and fabric being firmly bonded together by a thin, impermeable, cured rubber sheet.

A further object of the invention is to provide an improved polishing member having a fibrous felt polishing pad of relatively low tensile strength backed by a thin woven fabric of relatively high tensile strength and adhesively united thereto by the complete curing of a thin, partially cured, impermeable rubber sheet.

Still another object of the invention is to provide a circular, polishing block with a felt polishing pad having a strong woven fabric backing, there being an impervious, continuous, thin rubber sheet between the pad and fabric to serve the double purpose of a firm bond and a moisture barrier whereby the fabric and block are not subjected to undue moisture during polishing.

A further object of the invention is to provide a rapid low cost method for making a composite polishing member by simultaneously compressing an unpressed felt pad and a strong backing fabric while curing a thin rubber sheet therebetween to create an integral bonded unit.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawings and from the drawing in which

FIG. 1 is a diagrammatic perspective view of the forming step of the method of this invention showing the three plys or layers pre-cut to fit a polishing block.

FIG. 2 is a diagrammatic fragmentary side elevation showing the pressing, heating and curing steps of the method of this invention to form a composite polishing member.

FIG. 3 is a fragmentary side elevation in section, showing a square polishing member of this invention ready for clamping on a circular polishing block.

FIG. 4 is a view similar to FIG. 3 showing the polishing member clamped by its corners to the block by the clamping ring.

FIG. 5 is a bottom view of the polishing member shown in FIG. 3 with parts of each layer broken away to reveal the other layers, and

FIG. 6 is a bottom view, in perspective, of the polishing member and block shown in FIG. 4, a part of the polishing member and block being in section.

As shown in FIGS. 3 to 6 a glass polishing machine of a type well known in the trade includes a spider power rotated above the linearly advancing plate glass, each arm **20** of the spider carrying a freely rotatable polishing block **21**. There may be ten such blocks on each spider and each has been faced in the past with a polishing pad of felt. The plate glass **22** is advanced on a suitable table **23** movable, on tracks not shown, all in a well known manner. It has been customary to clamp each square of felt to its block **21** by the clamp ring **24**, the four corners of the felt being squeezed between the ring and block as shown in FIGS. 4 and 6. Because of the above mentioned continual lateral motion and the bend of the felt through an angle of 90° at the periphery of the block, the cyclic stress has been severe and such felt squares have tended to rupture near the angularly bent portions thereof.

In this invention, as shown in FIG. 1, a lower layer **26** of polishing material, preferably felted cattle hair **27**, is formed by pre-cutting to fit the polishing block such as **21** upon which it is to be attached. The layer **26** consists of compacted, interlocked, fibres **27** which have been felted

but not finally pressed into the desired thickness and at this stage it may be about 1¼ inches thick.

An upper layer **28** of strong backing fabric is formed, by pre-cutting, to fit over the lower layer **26**. Upper layer **28** is relatively thin as compared to layer **26** and is preferably heavy and closely woven from strong coarse strands such as hard twisted, textile yarns **29** and **30**. Layer **28** may be canvas, woven metal cloth or the like and the strands may be of cotton, jute, wool, rayon, nylon or woven glass fibres or the like or combinations thereof. While a non woven strong fabric might be used as layer **28**, a woven material has been found to be more satisfactory under the stresses and strains encountered in polishing glass.

An intermediate layer **33** of sheet rubber is also formed by pre-cutting whereby the layers **26**, **28** and **33** are coextensive in area and adapted to fit a block such as **21** by being cemented to the block face **34** or by having the corners bent up under the ring **24** as shown herein. The layer **33** is relatively thin with relation to the lower layer **26** and is preferably between .03 and .05 inches in thickness. The layer **33** is continuous and impervious in order that it may serve as an impermeable moisture barrier between the lower felted layer **26** and the fabric backing **28** and the block **21**. The rubber of layer **33** is only partially, or semi, cured and must be further heated to be completely cured or vulcanized.

The preformed and pre-cut layers **26**, **28** and **33**, as illustrated in FIG. 2, are then placed on the platform **35** of a press **36**, preferably of the hydraulic type with a head **37** and fluid actuated piston **38**. The relatively thin strong backing fabric layer **28** overlies the relatively thin partially cured rubber sheeting layer **33** and the layer **33** overlies the relatively thick, unpressed, felted layer **26** on platform **35**. Press **36** then applies pressure at about fifty pounds per square inch at a temperature of about 230° F. for about thirty minutes to compact the felted layer **26** to about one inch of thickness while simultaneously completely curing the partially cured rubber sheet layer **33**.

The laminated composite member **40**, resulting from the above described method steps, is shown in FIGS. 3 to 6. The felted lower layer **26** has a predetermined tensile strength at least equal to the tensile strength of an ordinary, one inch thick, felt polishing pad of the prior art but, as explained above, the physical stamina is insufficient to withstand fatiguing. Often this tensile strength is comparatively low and results in rupture, or fracture of the felt, near the turned up corners, early in the expected life of three to four hundred hours. The complete curing of the intermediate rubber sheet layer **33** results in a firm and permanent bond of great strength between the felt layer **26** and the strong backing fabric layer **28** and the three layers form an integral, composite unit of great resistance to tearing, or separation of the laminations.

The cured rubber sheeting of intermediate layer **33** forms an impervious moisture barrier which protects the block **21** and the backing fabric layer **28** from the moisture of the slurry to which the felt layer **26** is continually subjected. The tensile strength of the backing layer **28** is substantially greater than that of the felted layer **26**, especially when layer **28** is of heavy woven material such as canvas and the wet tensile strength of the composite member **40** is at least 90% greater than that of the felt layer **26** alone and with very low elongation. The composite polishing member **40** is sufficiently flexible to bend at right angles at the corners without the resultant shearing stresses causing bonding failure.

The upper backing layer **28**, when firmly bonded, and adhesively united, to felted lower layer **26** by means of the cured rubber sheet **33** increases the life of the polishing member **40** to enable it to polish effectively for the normal 300 to 400 hours of life and often for a longer period and the rubber and fabric prevent any possibility of the block **21** contacting the glass **22** when the member **40** becomes well worn down. In addition, the continual lateral cyclic stress, the right angular bends at the periphery of the block, the moisture of the slurry and any possible slippage between the member **40** and the block all fail to fracture or rupture the felt layer **26** under the severe conditions of glass polishing in a polishing machine.

Preferably the step of pressing, heating and curing the member **40** is accomplished under dry heat conditions. In FIGS. 3 and 5 the member **40** is shown in flat condition on a polishing block **21** and in FIGS. 4 and 6 the member **40** is shown clamped to the block by its corners such as **41**, **42**, **43** and **44**. The usual location of rupture in the felt pads of the prior art is near the lines of bend such as at **45** and **46** in FIG. 6. It has been found that merely cementing or adhering a strong backing sheet to the felt, by the usual types of adhesive, results in a weak bond and a felt which continues to rupture during use. A partially cured rubber sheet, however, cured in situ, between the felt and fabric even when only .020 inch thick flows readily and produces a highly successful bond which is far in excess of the normal splitting strength of the felt. The woven backing fabric has also been found to provide an anti skid surface in contact with the cast iron polishing block which prevents intermittent slippage tending to fatigue the felt. The co-efficient of friction between the metal and the felt is thus increased and undue flexing of the felt correspondingly reduced. This co-efficient of friction remains constant during the life of the member **40**, because the fabric layer **28** is isolated from the moisture of the felt by the rubber sheet layer **33**.

A satisfactory rubber sheet for forming the intermediate layer **33** is a sheet of from .030 to .050 inch thickness, about twenty-five inches square and weighing about two pounds per yard. Commercially it may be the equivalent of stock No. 50 of New Jersey Rubber Company of Taunton, Massachusetts, and it is only partially cured, so that it will flow readily and completely cure at about 230° F. under press pressure. Such sheet rubber can be handled at low cost, provides a uniform application thickness, requires no dryer operation and is simple to laminate between layers.

The backing layer **28** is preferably of closely woven heavy fabric such as canvas and a satisfactory fabric is obtainable commercially as No. 12 Hard Texture Duck. In any case it should be formed of a fabric having considerably superior mechanical and physical properties to the properties of the usual felt polishing pad now used in the glass polishing industry and should be of relatively high environmental stability.

I claim:

1. A composite polishing member for use on a polishing machine, said member comprising a relatively thick, felt, polishing pad having a predetermined resistance to rupture under the cyclic fatigue stresses of said machine; a relatively thin, strong, closely woven, backing fabric having substantially greater resistance to rupture than said polishing pad and a relatively thin, impermeable, bonding sheet of cured rubber laminated between said pad and fabric, said polishing pad, rubber sheet and backing fabric being adhesively united into a composite, integral polishing member by means of said cured rubber sheet.

2. A combination as specified in claim 1 wherein said polishing pad is formed of compacted, interlocked felted animal fibres and said backing fabric is formed of closely woven, strong strands of textile fibres.

3. A composite polishing member for use on a polishing machine, said member comprising a polishing pad of felted fibres; a reinforcing backing fabric of woven fibrous strands and an impermeable bonding sheet of cured rubber laminated between, and vulcanized to, said pad and fabric for adhesively uniting the same into a

flexible integral unit, said fabric resisting forces tending to rupture said pad and said rubber sheet isolating said fabric from saturants on said pad.

4. A combination as specified in claim 3 wherein said pad is felted of compacted, interlocked fibres and is uniformly about one inch thick, said fabric is of closely woven, strong, textile fibre strands having a substantially greater tensile strength than said pad and said rubber sheet is of a uniform thickness of about .030 to .050 inch.

5. An improved plate glass polishing member comprising a felt polishing pad firmly adhered and united to a stable, closely woven, reinforcing, backing fabric solely by means of an impermeable, cured rubber bonding sheet forming a moisture barrier between said pad and fabric.

6. A composite, laminated plate glass polishing member comprising a lower layer of polishing pad of felted fibres having a predetermined tensile strength; an upper layer of relatively soft, flexible, closely woven reinforcing, backing material having substantially greater tensile strength than that of said felted lower layer and an intermediate, moisture proofing layer of cured impermeable rubber sheeting, coextensive in area with said upper and lower layers, said upper and lower layers being adhesively united solely by means of said cured rubber sheeting.

7. A composite polishing member for use on a polishing machine, said member comprising a relatively thick, felted pad of compacted, interlocked fibres having a predetermined resistance to fracture under the stress of polishing; a relatively thin, heavy, closely woven, backing fabric of coarse, hard, twisted yarns having considerably greater durability and resistance to fracture than said pad and a relatively thin impermeable sheet of cured rubber coextensive in area with said felted pad and backing fabric and laminated therebetween, said pad, rubber sheet and backing fabric being adhesively united into a flexible, composite polishing member by means of said cured rubber sheet.

8. A square polishing member for use on a polishing machine, said member comprising a relatively thick polishing pad of felted fibres; a relatively thin, closely woven, backing fabric of canvas and a relatively thin, impermeable sheet of cured rubber extending between said pad and fabric, said pad, sheet and fabric being each of identical square outline and being adhesively

united to each other solely by means of said cured rubber sheet.

9. In combination a plate glass polishing block of circular outline, a composite polishing member of square outline and clamp ring means for holding the corners of said member on said block, said polishing member having a relatively thick lower layer of felted, compacted, interlocked fibres, a relatively thin upper layer of closely woven, strong, strands and a relatively thin, impermeable, intermediate layer of cured rubber sheeting extending between said upper and lower layers, said layers being adhesively bonded to each other by means of said cured rubber sheeting, said polishing member resisting rupture induced by the stresses of polishing and said impermeable, rubber sheeting isolating said block and upper layer from saturants applied to said felted, lower layer.

10. The method of producing a composite polishing member for glass polishing machines which comprises the steps of forming a lower layer of unpressed felt, an intermediate layer of thin, impermeable, semi-cured, sheet rubber and an upper layer of closely woven, strong strands and then simultaneously compressing said unpressed felt layer while joining layers together by vulcanizing said semi-cured rubber layer at a temperature of about 230° F. for about thirty minutes until complete curing of said rubber takes place to firmly bond said lower, felted layer and said upper woven layer on opposite faces of said intermediate rubber layer.

11. A method as specified in claim 10, wherein said layers are hydraulically pressed together at a pressure of about fifty pounds per square inch.

12. A method as specified in claim 10 wherein said rubber is dry cured in a moisture free atmosphere.

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