Jan. 13, 1959 E. D. PHILLIPS 2,867,954

POLISHING PAD AND METHOD OF MAKING THE SAME

Filed Sept. 26, 1956

FIG.8

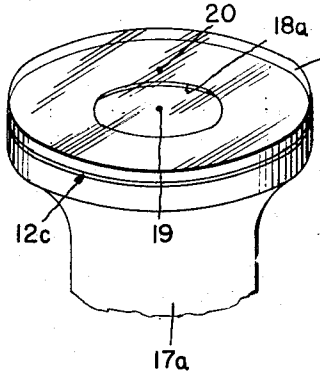


FIG.1

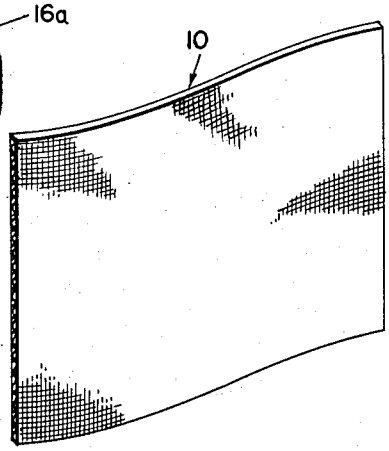


FIG.4

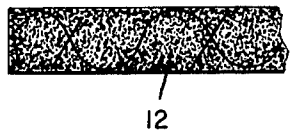


FIG.6

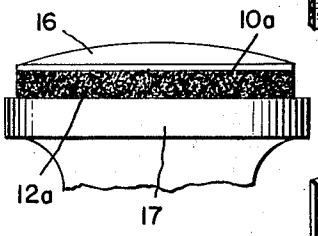


FIG.2

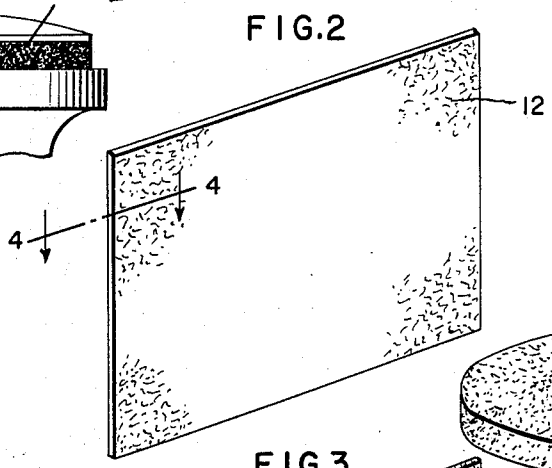


FIG.7

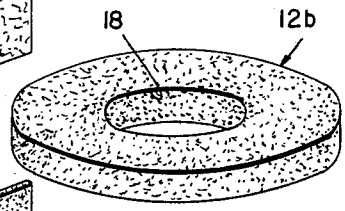


FIG.5

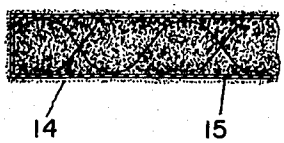
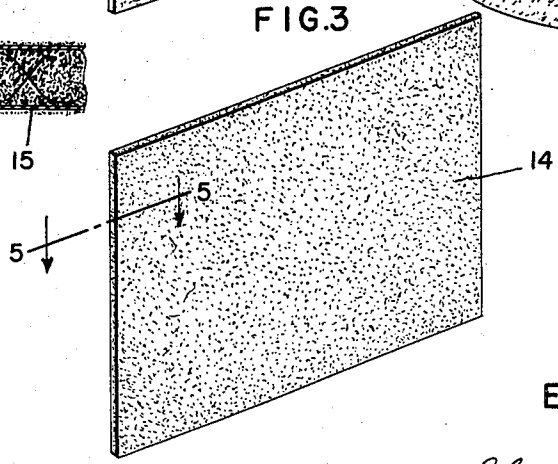


FIG.3



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POLISHING PAD AND METHOD OF MAKING THE SAME

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9 Claims. (Cl. 51—195)

This invention relates to the class of abrading and polishing and is directed particularly to polishing pads for use in the polishing of glass, more particularly optical glass in the form of lenses.

The present practice followed in the polishing of lenses embodies the use of a piece or sheet of absorbent material such as flannel or felt which is secured by a suitable adhesive, usually pitch, to a dop and this pad is then wetted and the polishing rouge is put on loose or in a dry condition and the rouge is continuously added as the polishing operation progresses. This practice results not only in a scattering of the rouge over adjacent parts of the machine or mechanism but it is also very wasteful and, since the polishing rouge is relatively expensive, it is highly desirable that as little as possible of the same be wasted.

Another disadvantage associated with the use of the polishing rouge being applied by hand to the pad while a polishing operation is in progress, is that the application is unevenly accomplished so that the polishing operation is not as uniformly produced as is desired.

In the light of the foregoing, a particular object of the present invention is to provide a new type of polishing pad which does not require that the rouge be applied while the polishing operation is in progress but which carries the rouge already evenly distributed over and secured to its surface so that there is a uniformity in the results produced and there is substantially little loss or waste of the rouge.

Another object of the invention is to provide a polishing pad which is impregnated with a heat softenable material so that it can be readily made to adhere to the dop and which, in addition, carries the rouge evenly distributed over its surface and secured to the surface by a water-soluble adhesive so that as the pad is being used, it may be moistened and the rouge will be wetted so that it will be rubbed over the surface of the lens in a moist condition and the desired uniform abrading of the surface will be accomplished to reduce any inequalities thereof to a smooth continuous contour.

Another object of the invention is to provide a novel method of producing the hereinbefore described polishing pads whereby the pads will be provided over both surfaces with an evenly applied coating of the rouge and the rouge will be maintained thereon until the pad is applied to the dop for use and will then be gradually given up and loosened after the pad has been wetted and as the surface of the pad and the surface of the layers are moved relatively to one another in contact.

Another object of the invention is to provide a new method and means of mounting a lens on and securing it to an adapter, in properly centered position, by the provision of a body impregnated with pitch or other thermoplastic bonding substance, whereby there is not only obtained the proper or accurate centering or positioning of the lens on the adapter, but there is effected a material saving in the time required for mounting the lens over that required for mounting or blocking a lens by the present or conventional method.

In the accompanying drawing there are illustrated different stages in the production of a polishing pad in accordance with the present invention wherein:

Fig. 1 is a view in perspective of a sheet of absorbent material which may be in the form of felt or serge flannel and which may be of any desired size but preferably of the size conventionally employed which is approximately 2½ x 3 inches;

Fig. 2 represents the sheet of absorbent materials, shown in perspective, after being impregnated with a suitable heat softenable material such as pitch, balsam, rosin or the like;

Fig. 3 is a view in perspective of the complete pad, which comprises the pad of Fig. 2 to which has been applied a coating over all surfaces of the polishing rouge;

Fig. 4 is a partial section on an enlarged scale, taken on the line 4—4 of Fig. 2, showing the penetration of the adhesive material through the fabric;

Fig. 5 is a partial section on an enlarged scale, taken substantially on the line 5—5 of Fig. 3, showing the surface coating of the rouge adhesively secured to the impregnated fabric;

Fig. 6 is a view in side elevation of a modified form of pad designed for use as a blocking pad to secure a lens to an adapter to hold the lens in position for grinding or other operations, the lens and a portion of an adapter being shown in side elevation;

Fig. 7 is a view in perspective of a modification of the blocking pad shown in Fig. 6;

Fig. 8 is a view in perspective of another modification of the blocking pad showing the same on the adapter and showing a lens secured to the adapter thereby.

In carrying out the present process for producing the described polishing pad, a sheet or body of absorbent material of the desired size is first introduced into and thoroughly soaked with a solution of an adhesive material which is relatively hard when dry but which can be softened by heat and also which, when so softened, becomes tacky or adhesive. For example, such material may be any one of the several well-known substances which are used for mounting lenses or other bodies on dop sticks such as pitch, balsam, rosin or asphalt. The selected substance is dissolved in a suitable volatile solvent such as benzol, naphtha or alcohol and the concentration of the material in the solvent may be varied as desired, as hereinafter set forth.

The sheet or body of absorbent material is introduced into and thoroughly soaked with the solution, which solution for convenience of description, may be referred to broadly as pitch solution, and after being thoroughly soaked with this pitch solution, the body is removed from the solution and squeezed out until fairly dry and the solvent is then allowed to evaporate so as to leave a deposit in and entirely through the body of the pad.

In referring to "pitch" this term is used in its specific sense to define the residue in the distilling of tar, wood tar or petroleum and it is also used generically to define the various substances which are used in connection with the mounting of lenses on adapters such as the previously referred to balsam, asphalt, rosin and the like.

After the solvent has evaporated from the absorbent body and the deposited pitch has more or less hardened, the body is subjected to a treatment with the water mixture, or suspension of rouge or with water containing an adhesive having the rouge mixed or dispersed therein. The pitch impregnated body has some porosity and this treatment in the liquid accomplishes the attachment of the rouge particles to the surfaces of the pitch carrying absorbent body as well as some penetration of the particles into the pores and the body is then permitted to dry so that the adhesive will firmly hold the rouge therein and thereon.

The accompanying drawing illustrates the three stages of development in the making of the polishing pad.

In Fig. 1 the numeral 10 generally designates a suitably formed piece of absorbent body which is here shown

as a rectangular piece of fabric which may be serge material, as previously stated, or it may be a body of felt. The body is relatively thin or approximately the thickness of conventional serge cloth used in garment manufacture and, as previously stated, while it may be of any desired size, a convenient size has been found to be approximately 2½ x 3 inches.

The solution of pitch in which the absorbent body is soaked may vary considerably in strength according to the quantity of pitch which it is desired to add to or have the body take up. The pitch concentration may be varied to suit any particular application. As one example, and without intending to limit the invention, it may be stated that there may be employed a solution of pitch in alcohol or other selected volatile solvent in which the pitch content is approximately twenty-five percent. With a solution of this strength, when the absorbent sheet or body is thoroughly soaked therein, and is then taken out and squeezed to a fairly dry condition and the remaining solvent then allowed to evaporate, the pad will retain the pitch in the proportion of approximately two grams to the ounce of felt.

If it is desired that the absorbent sheet or body of felt or serge material carry a greater quantity of the pitch per ounce of material, it will of course be obvious that the strength of the solution may be increased as, for example, for a body containing approximately 4 grams of pitch to the ounce, a fifty percent solution of the pitch in alcohol or other selected volatile solvent may be employed.

While in the foregoing paragraphs, reference has been made to alcohol as a solvent, use may be made of any other volatile solvent suitable for dissolving the particular type of pitch being used. For example, use may be made of benzol, naphtha or mineral spirits for the solvent. It will be understood, accordingly, that it is not desired that this invention be limited to the use of a specific solvent but only that the solvent be of relatively rapidly volatilizing character and suitable for dissolving the selected pitch material.

The pitch concentration in the pad must vary inversely with the polishing speed at which it is used. In other words, the higher the speed of rotation of the polishing unit, the lower will be the amount, or concentration of pitch in the polishing pad. Increasing the speed of the polishing pad against the lens increases the heat generated by friction and, accordingly, if a high speed is employed when using a pad having a high concentration of pitch, the pitch would soften to the point where it would stick to the glass. Small lenses are polished at higher speeds than large lenses and, accordingly, the pads used in polishing the small lenses must have a lower pitch concentration. As an illustration of the foregoing where the polishing pad is rotated at approximately 90 R. P. M. the pitch concentration might be as much as 10%; at 150 R. P. M. the pitch concentration would be reduced to about 5% and at 350 R. P. M. the pitch content in the pad would be reduced to about 3%. The values are, of course, only approximate for prescription house grinding and might be changed slightly for precision grinding.

As a further illustration of the amounts or proportions of the materials which may be employed for impregnating the polishing pads for use upon lenses of the following designated diameters and at the indicated speeds, reference is had to the following table setting forth diameters for three lenses:

Lens diameters	12″	6″	3″
Speeds—R. P. M.	90	120	160
Solvent (gallons)	10	10	10
Pitch (pounds per gallon)	30	15	7½
Approximate saturation of pads with pitch (grams per square inch)	1	.5	.25

After the absorbent body **10** has been soaked in the pitch solution and squeezed out and permitted to dry, it will be of more or less stiff character and the fibers of the fabric will be matted together by the pitch so that the body will appear substantially as illustrated in Fig. 2 where the pitch material is designated **12**.

It will be understood, of course, that in manufacturing the polishing pads, a large number of the bodies **10** will be treated at one time and after the bodies have been dried out to have the relatively stiff form and appearance of Fig. 2, they are then subjected to the second stage of treatment for effecting the coating of the surface with the desired polishing material or rouge. For effecting the application of the rouge to the pitch impregnated body, there is prepared a water solution of a suitable glue material which will provide the proper adhesive action for bonding the rouge to the body. This adhesive or glue material is of a vegetable character and may consist of gum arabic or gum tragacanth. The preferred glue solution comprises approximately ½ pound of the gum to the gallon of water and in a gallon of this solution there is mixed approximately 2 pounds of the selected rouge which may be cerium oxide, zirconium oxide, iron oxide, lithium oxide, chromium oxide, magnesium oxide, titanium oxide or any other abrasive suitable for the polishing of lenses.

It is found that the amount of the rouge which is taken up by the pitch impregnated pads varies according to the concentration of the mixture of the rouge and adhesive in the water. In other words, the more fluid the rouge mixture or suspension the greater quantity of rouge that will be adhered to the pads.

A mixture of approximately 35% rouge, 5% adhesive and 60% water has been found satisfactory for most purposes but the proportions of the rouge and adhesive to the water may vary slightly above or below these amounts. The approximate saturation of the rouge or amount of the rouge on and in the pads may vary from 1½ grams to two grams per square inch for lenses respectively of 12″, 6″ and 3″ in diameter. It will be seen from this upon reference to the above table setting forth the quantity of pitch in the pads for the same lens sizes when used at the speeds set forth that the amount of the rouge per square inch is inversely proportional to the amount of pitch.

The pitch-impregnated bodies are tumbled or agitated in other manners in the adhesive-rouge mixture. For this purpose, a conventional type of tumbling drum may be employed. By this means, the pitch-impregnated bodies or pads become thoroughly coated on all surfaces with the rouge. The bodies are then removed and permitted to dry thoroughly and the glue will thus effect the strong attachment of the particles of the rouge to the surfaces and in the pores of the body and the bodies or pads will then be ready for use.

In using the pad thus treated, it is attached to a dop by means of heat which will sufficiently soften the pitch or, if desired, warm pitch may be placed on the dop and the pad pressed thereon where it will be securely held when the pitch has cooled and solidified. It will only then be necessary, in the use of the pad, for the polishing operation, to moisten the surface of the pad with water and thus there is eliminated the present practice of applying the loose or dry powder to the wetted pad with the resultant loss or wasting of the rouge. As a result, by the use of pads constructed or produced according to the present invention, a considerable saving of the polishing material is effected and, in addition, the distribution of free rouge over adjacent parts of the polishing machine with resultant damage to moving bearings and other parts is also eliminated.

Fig. 3 of the drawing illustrates the completed polishing pad and the numeral **14** designates the coating of rouge which is bonded to the body by the water soluble adhesive which, in Fig. 5, is designated **15** and forms a

thin flexible skin or coat over the surface **12** which is predominantly dried pitch.

The drawing in Fig. 6 illustrates another embodiment of the invention showing the use as a blocking pad of a body of felt designated **10***a*, heavily impregnated with pitch, which is designated **12***a*, and which entirely fills the interstices of the absorbent body of felt, serge or other material in the same manner as the pitch **12** fills the interstices of the hereinbefore referred to body **10**. This heavily loaded absorbent body, that is, the body heavily loaded with the pitch material, is for use as a means of securing a lens **16** to the top or head of a dop **17** for a grinding or polishing operation. By merely warming the heavily pitch-loaded or impregnated fabric body and pressing it on the dop and then pressing the warmed lens on the pad, the desired attachment of the lens to the dop can be attained without using pitch alone in the present conventional manner. This has the advantage that after the grinding or polishing operation is completed, the lens can be easily removed by inserting an instrument between the pad and the dop and without danger of damaging the lens whereas the conventional practice of using a mass of pitch to bond the lens directly to the dop frequently results in damaging the lens as considerable difficulty is experienced in breaking the pitch away from the dop.

Figs. 7 and 8 illustrate two modifications of the blocking means shown in Fig. 6. These modified forms of blocking means or blocking pads which are used to secure a lens to an adapter are so designed that a new method can be followed for locating the lens in the proper position upon the adapter, in addition to the fact that the bodies themselves provide an improved time saving means for securing the lens on the adapter. In the modified structure shown in Fig. 7, the blocking body or pad is illustrated as being of circular form like the pad **12***a*, this modified form being generally designated **12***b*. This may be a pad of relatively thick absorbent fibrous material and it is, like the pad **12***a*, heavily impregnated or substantially completely saturated with a thermoplastic bonding agent such as pitch, for example. The body **12***b* is provided with a central opening which is designated **18** and while it is shown as being circular, the opening may, if found convenient, be of any other suitable contour, one of the primary reasons for providing the opening being to facilitate the centering of the lens on the adapter as will be hereinafter described. Another reason for providing the opening is that the lens can be more firmly positioned on the adapter without rocking which might not be done if the pad is of solid form throughout, although the solid form of pad, such as is shown in Fig. 6, is new in the art and can be used for certain blocking operations.

The lens securing body or blocking body shown in Fig. 8 is also in the form of a flat disc of absorbent fibrous material but is of materially thinner or of less thickness than the pad shown in Fig. 7. This thinner blocking pad or body is generally designated **12***c* and comprises specifically a thin paper sheet which is saturated with pitch or other suitable thermoplastic bonding material in the same manner as the pads **12***a* and **12***b*. The pad **12***c* likewise has a central opening which is designated **18***a* for facilitating the centering of the lens in the manner about to be described. The body or pad **12***c* is of a uniform thickness of approximately .0015".

In Fig. 8, the adapter is designated **17***a*. This adapter may be exactly the same construction as the adapter **17** but for the purpose of following description a separate designating numeral has been used and in the use of this adapter with the lens securing body **12***b* or **12***c* which has a central opening, the adapter is provided with a central reference point or marking **19** which the opening in the lens securing body permits the operator to see when placing the lens on the adapter.

In the use of the lens securing body **12***b* or **12***c* the placement on the surface of the adapter of the reference point or marking **19** and the provision of the opening in the securing body enables the operator to accurately position and secure on the adapter the lens to be worked upon, such lens here being designated **16***a* in Fig. 8. In so placing or securing the lens to the adapter, the securing body or blocking pad, whether it be the pad **12***b* or the pad **12***c*, is first made to adhere to the surface of the adapter by suitable adhesive with the reference point approximately in the center of the opening **18** or **18***a*. The lens **16***a* has the optical center located and marked thereon by a suitable marker, the optical center designating spot being indicated by the reference numeral **20**. The lens is then suitably heated so that when it is pressed on the pad **12***b* or the pad **12***c* it will soften the thermoplastic bonding material and become fixed or stuck thereto. Also, in this placing of the lens in position on the adapter the optical center indicating mark or spot **20** is lined up with the center mark or reference point **19** on the adapter and thus the lens can be accurately placed or blocked.

In the manufacture of the polishing and blocking pads, various absorbent materials may be employed. Among these materials are jute, tampico, wool, felt, burlap, synthetic fabrics, such as Dacron, paper and the like.

The theory of polishing lenses with rouge material embraces the idea that the unpolished lens surface or the rough surface is made up of a multiplicity of high points of microscopic size and when the polishing material is applied or rubbed over the surface, considerable friction is produced and concentrated at these high points and due to the extreme localization of the friction at such points, high temperatures are generated so that the points of the material being treated will flow off with the wiping action of the rouge. Thus these high points will all be reduced to a common smooth plane giving the polish desired.

In the use of a pad designed and constructed in accordance with the present invention, a more uniform smooth polished surface is attained than is possible by the employment of the procedure at present in vogue, in addition to the fact that there is great reduction in the waste of the rouge.

I claim:

1. A lens polishing pad comprising a flat body of an absorbent material impregnated and bonded throughout with an organic resin and a polishing rouge combined with and retained in the resin impregnated body by an adhesive and covering at least one side of the body.

2. A lens polishing pad comprising a flat non-laminar body of fibrous material capable of absorbing and retaining a fluid, an organic resin absorbently dispersed in and throughout the body, and a polishing rouge covering at least one side of said body and bonded therein and thereto by a non-resinous adhesive.

3. A lens polishing pad comprising a body of absorbent fabric, an adhesive completely filling the interstices of the fabric to the same density throughout and being of a character to be softened by heat, and a polishing rouge in the interstices and covering at least one surface of the body.

4. The invention according to claim 3, wherein the rouge is retained in and on the surface of the body by a water soluble adhesive.

5. A lens polishing pad comprising a sheet of absorbent material, a filling substance in and extending throughout the material of the sheet and being characterized by softening and becoming adhesive when heated and polishing rouge covering a surface of the sheet and secured thereto by vegetable glue.

6. A pad for use in working upon an optical lens, comprising a body of fibrous material capable of absorbing a fluid and having distributed therethrough between and in the fibers thereof a thermoplastic substance, and a polishing rouge secured to and within said body by an elastic water soluble adhesive.

7. The invention according to claim 6, wherein the rouge content approximates from one and one-half grams to two grams per square inch of pad surface.

8. The invention according to claim 6 wherein the amount of rouge per square inch of pads is inversely proportional to the amount of thermoplastic per square inch therein.

9. The invention according to claim 6, wherein the rouge content ranges approximately from one and one-half grams to two grams per square inch of pad and the thermoplastic concentration ranges approximately from one gram to 25/100 gram per square inch.

References Cited in the file of this patent

UNITED STATES PATENTS

331,632	Haas	Dec. 1, 1885
820,694	Bond	May 15, 1906
1,141,371	Virenburg	June 1, 1915
1,477,975	Olson	Dec. 18, 1923
1,693,598	Gamble	Dec. 4, 1928
2,131,309	Bowen	Sept. 27, 1938
2,152,392	Tone	Mar. 28, 1939
2,450,433	Seeman	Oct. 5, 1948
2,520,763	Goepfert et al.	Aug. 29, 1950