

[11] 3,607,485

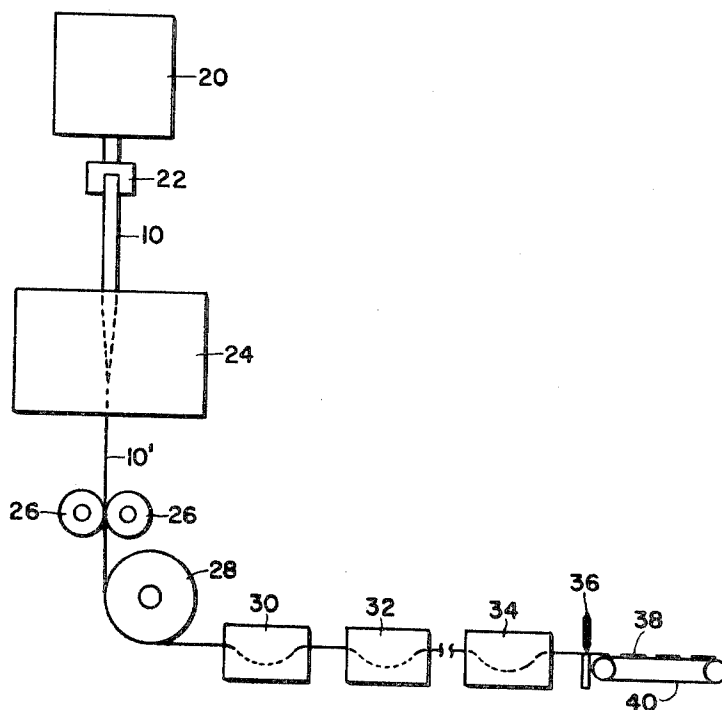
[54] METHOD OF MAKING GLASS RAZOR BLADES
4 Claims, 3 Drawing Figs.

[56]	References Cited	
	UNITED STATES PATENTS	
2,555,214	5/1951	Wallach et al.
2,993,301	7/1961	Muller et al.

1,147,141	4/1963	Germany
648,765	10/1965	Belgium
747,759	4/1956	Great Britain

"Etching Glass in Acid Baths" O. V. Guzhavin et al. *Steklo Byull. Gosudarst.* (1958) cited from *Chem. Abs.* Vol. 55 (1961) 9817h.

ABSTRACT: A blank of vitreous material is accurately ground to a desired razor blade configuration with specific dimensions, which are a multiple of the dimensions of the end product as represented by a predetermined attenuation ratio, and the blank is heated to about its softening point and drawn down with a desired attenuation to produce a continuous razor blade ribbon of uniform predetermined cross-sectional dimensions. The ribbon is then polished in an acid bath, provided with a lubricating coating, and cut into desired lengths for packaging.



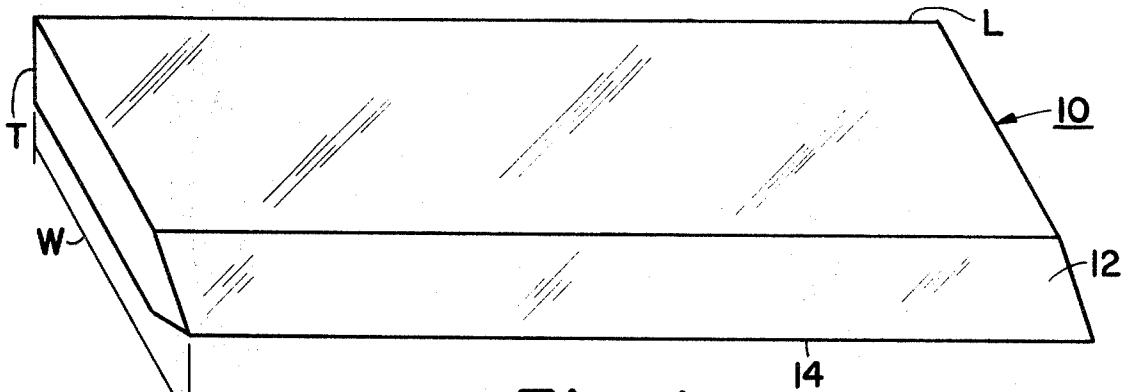


Fig. 1

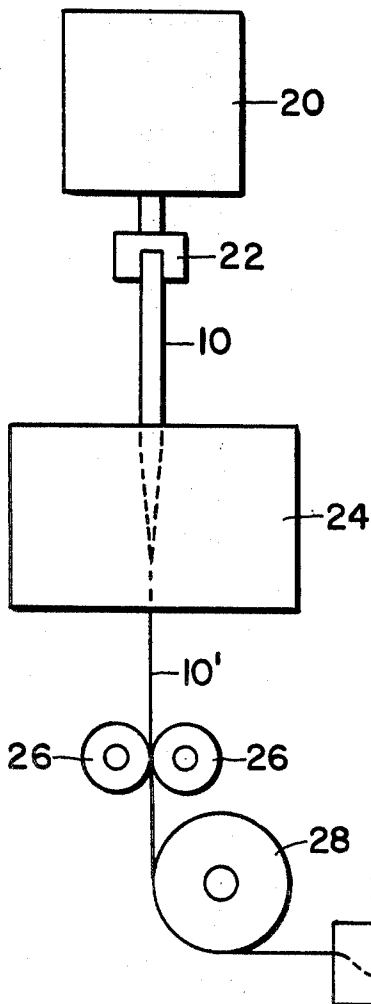


Fig. 3

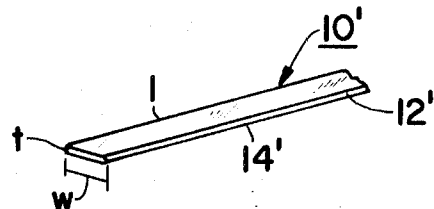


Fig. 2

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METHOD OF MAKING GLASS RAZOR BLADES

BACKGROUND OF THE INVENTION

The invention resides in the field of razor blade manufacture, and particularly is concerned with the specific problems encountered in the manufacture of glass razor blades.

The state of the prior art is represented by U.S. Pat. No. 2,555,214 to Wallach et al. Basically, as shown in such patent, the prior art methods consisted of grinding each individual final-sized razor blade blank to substantially ultimate keenness and then subjecting the blank to a series of 10-15 immersions of about 5 seconds each in a bath of concentrated hydrofluoric acid. This known method has not been entirely satisfactory since it is not only difficult to repeatedly produce a uniform product and control blade geometry, but also the process is extremely slow since it requires a relatively long acid-polishing operation to eliminate the raw grinding flaws. Further, it is virtually impossible to grind edge configurations other than a conventional V-shaped edge.

The present invention not only obviates the problem of repeatedly producing uniform blade structures, but also facilitates the production of unusual shapes by initially precision-grinding a large blank to a desired configuration, and then drawing and attenuating such blank while retaining its relative dimensions to produce a uniform strip or ribbon of razor blade configuration. Further, due to the drawing down and attenuation of the previously ground edge, it is possible to now polish the same in a relatively short time period. Finally, shaving comfort is obtained by applying a lubricating coating to the razor blade strip before it is cut into desired lengths for packaging.

SUMMARY OF THE INVENTION

The present invention sets forth a completely new concept in the manufacture of glass razor blades by beginning with a vitreous blank many times the size of the desired finished product, and by incorporating a controlled redraw operation to attenuate and reduce the blank to the desired final dimensions. Redraw, as used in the art, refers to any drawing operation wherein the article being drawn is initially in a solid state, as opposed to drawing from a molten bath. By beginning with an enlarged blank having a volume per linear length of from about 10 to about 1,000 times larger than the same per linear length volume of the desired final product, it is possible to form a master blank with virtually any desired blade configuration due to the ease in handling and machining such a relatively large size blank. Further, by controlling the temperature of the blank during the redraw process, the relative dimensions of the blank are uniformly retained as the blank is attenuated and reduced in size to that of the desired end product. Not only does the controlled redraw of the master blank produce repeatable uniformity of end product along its length, but also any slight imperfections in the cutting edge are so reduced in degree during the redraw that only an extremely short acid polish is required, thus materially reducing the time previously required to produce glass razor blades. Finally, the lubricating coating provides the glass razor blade with improved shaving comfort.

It thus has been an object of the present invention to obviate the tedious prior art process of separately grinding and polishing each individual razor blade, by providing an improved process of redrawing a relatively large precision-ground master razor blade blank into an elongated razor blade ribbon of desired configuration which is then readily acid-polished for strength and sharpness, and finally coated with a lubricating media for shaving comfort.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view in reduced scale of an enlarged or master razor blade blank which has been precision ground to a desired configuration with predetermined dimensions.

FIG. 2 is a perspective view of a portion of a razor blade strip formed by attenuating and reducing the blank of FIG. 1 to a desired end product, which may have a volume per linear length, or stated another way, a cross-sectional area of about one-tenth to one-thousandth of the volume per same linear length, or cross-sectional area, of the master blank shown in Fig. 1.

FIG. 3 is a somewhat schematic view in elevation illustrating a continuous process for forming razor blades in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An enlarged or master blank 10 is shown having a tapered front face or facet 12 of desired angle forming a cutting edge 14. The blank 10 is machined, such as by precision grinding, to desired dimensions so that edge L represents the length, edge T represents the thickness, and the distance W between edge T and edge 14 represents the width.

Referring now to FIG. 2, a portion of a redrawn razor blade ribbon 10' is shown having a tapered face or facet 12' forming a cutting edge 14'. The longitudinal edge of the ribbon 10' is shown at 1, the thickness is shown at t , and the width is shown by w . By maintaining the proper parameters during the redrawing operation, the relative dimensions between the master blank 10 and the razor blade ribbon 10' will remain constant such that $w/w=7/t$. Further, the specific angular configurations ground into the master blank 10 will be uniformly retained along the entire extent of the razor blade ribbon 10'.

Referring now to FIG. 3, a support member 20 is shown having a clamp 22 for controllably feeding the master blank 10 into an electrically powered redraw furnace 24. The furnace has an open portion extending vertically therethrough which is lined with electric heating elements so as to soften the blank 10 for attenuation as it passes through such opening. Suitable pulling means such as driven tractor belts or pull rollers 26 are driven to draw down and attenuate master blank 10 into razor blade ribbon 10'. The downward drawn ribbon 10' is then preferably transposed to a horizontal position such as by a suitable idler roller 28, so that it may be sequentially passed through an acid-polishing bath 30 and a washing bath 32.

It should be noted that the broken lines in FIG. 3 following the bath 32 indicate that a plurality of alternating acid-polishing and washing baths may be positioned within the line, depending upon the speed at which the razor blade ribbon 10' is moving. We have found that the drawn ribbon blades may be adequately sharpened with as little as three, 5-second dips in an acid-polishing bath. It is necessary that the drawn blade be washed in a suitable solution such as a hot 10 to 500 percent nitric acid solution, after each dip in the acid-polishing solution, in order to remove the reaction products and thus produce a smoother and straighter edge.

The preferred acid-polishing bath comprises a mixture of hydrofluoric acid and sulfuric acid, and although we have experienced exceptionally good results with a 50 percent solution of 48 percent grade HF and a 50 percent solution of reagent grade H_2SO_4 , the particular mixture of HF and H_2SO_4 may be varied as desired by merely adjusting the acid-polishing time to the particular solution utilized. In addition, other solutions such as acetic acid or sodium hydroxide will function to sharpen the blade edge; however, they do not provide the flaw-free strengthened edge produced by the JF and H_2SO_4 solution. The period of immersion of the razor blade strip in the 50/50 acid solution of HF and H_2SO_4 , may vary from about 5 to about 15 seconds, with each immersion being followed by a washing in a nitric acid solution.

Following the acid polishing and washing operation, the drawn razor blade ribbon 10' is dried and then dipped into a coating bath or dispersion 34 to receive a lubricating coating for shaving comfort. Preferably, a suitable coupling agent, such as a silicone catalyst produced by the General Electric Company under SC-3963 is applied to the dried ribbon before

coating, to enhance the adhesiveness between the glass and the lubricating coating. Although various coatings may be applied, our now preferred coating for glass razor blades comprises a tetrafluoroethylene fluorocarbon resin such as produced by the E. I. DuPont de Nemours and Company of Wilmington, Del., under the trademark Teflon TFE 3170. The coated ribbon is then cured and cut into blades 38 of desired lengths by cutters 36, and transported along conveyor 40 for packaging.

The redrawing operation must be carefully controlled in order that dimensional uniformity and configuration integrity is maintained in the drawn ribbon. The attenuation ratio between the master blank and drawn ribbon may vary from about 10 to 100. The upper limit is merely deemed to be a practical upper limit, whereas poor dimensional control is evidenced when operating below the lower limit. Further, we have found that the master blank should be heated to a temperature approximately corresponding to its softening point in order to provide the desired dimensional uniformity. For a glass having a density of about 2.5 g./cm.³, the softening temperature corresponds to a viscosity of 10^{7.4} poises.

Softening point viscosity will of course vary with glasses of different densities; however, as a general rule we have found that the master blank may be satisfactorily redrawn at a viscosity of between approximately 10⁵ to 10⁹ poises. When the viscosity drops below 10⁵ poises the glass has a tendency to flow and round out, whereas when the viscosity goes above 10⁹ poises the glass has a tendency to distort. When the ribbon is pulled at high speeds, such as above about 100 inches per minute, it is of course necessary to provide the furnace with a higher temperature than the softening point temperature of the glass, so that the glass itself reaches the softening point as it is rapidly moving therethrough. The following is set forth as one specific example of forming razor blades in accordance with the present invention; however, it is to be understood that such an example is not limiting in nature.

A master blank was ground to a desired blade configuration with the blank being 18 inches long, 5.504 inches wide, and 0.200 inch thick. The glass was fed into a furnace at a rate of one-eighth inch per minute with the furnace maintained at 910° C., the softening point of the glass. The glass reached a viscosity of 10^{7.5} poises and was withdrawn from the bottom of

the furnace at a rate of 38.3 inches per minute, producing an elongated razor blade strip or ribbon having a length of 4,284 inches, a width of 0.314 inch, and a thickness of 0.011 inch, thus representing an attenuation ratio of 17.5. The theoretical ribbon length of 5,500 inch is not obtained due to the fact that a portion of the blank is retained within the holding clamp and not attenuated.

Although we have set forth the now preferred embodiments of our invention, it will be apparent to those skilled in the art that various changes and modifications may be made thereto without departing from the spirit and scope thereof as defined in the appended claims.

1. A method of producing glass razor blades comprising, forming a master glass blank with an enlarged razor blade configuration of predetermined dimensions having a volume per linear length of from about 10 to 1,000 times larger than the same per linear length volume of the desired razor blade, heating such blank to a temperature approximately corresponding to the softening point of the glass and sufficient to obtain a glass viscosity of between 10⁵ and 10⁹ poises, drawing the heated glass blank and attenuating the same down to a ribbon having a volume per linear length of from about 1/10 to 1/1,000 of that of the blank while maintaining the desired razor blade configuration, subjecting the razor blade ribbon to a polishing solution for providing a sharpened edge, and applying a coating to the drawn ribbon to provide a glass razor blade having improved shaving comfort.

2. A method of producing glass razor blades as defined in claim 1 wherein the relative dimensions of the blank and the ribbon are maintained during attenuation such that the width of the blank is to the width of the ribbon as the thickness of the blank is to the thickness of the ribbon.

3. A method for producing glass razor blades as defined in claim 1 wherein the ribbon is subjected to a bath of hydrofluoric and sulfuric acids.

4. A method of producing glass razor blades as defined in claim 1 wherein the ribbon is alternately polished in an acid solution and washed in an aqueous solution, a fluorocarbon resin coating is then applied to the acid-polished glass ribbon, and the coated ribbon is then cut into razor blades of desired length for packaging.

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