Feb. 5, 1935. O. ROTH 1,989,886

MANUFACTURE OF SAFETY RAZOR BLADES

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Fig. 1.

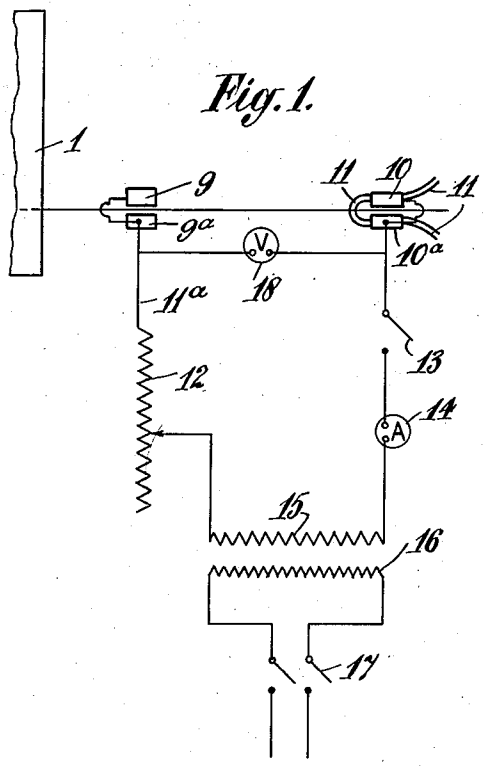
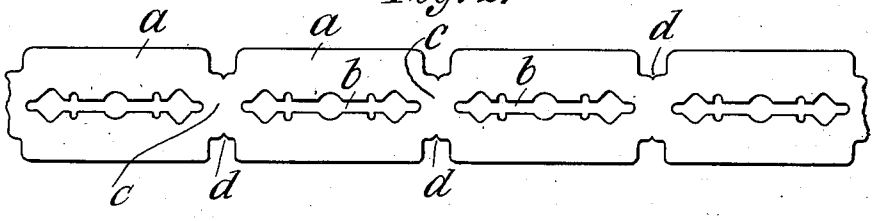


Fig. 2.



INVENTOR
Otto Roth.
by H. W. Conway. Atty.

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MANUFACTURE OF SAFETY RAZOR BLADES

Otto Roth, Tempelhof, Berlin, Germany, assignor to Gillette Safety Razor Company, Boston, Mass., a corporation of Delaware

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7 Claims. (Cl. 148—10)

The present invention relates to the manufacture of safety razor blades of the thin flexible type having a continuous slot of substantial length, e. g., extending substantially over the whole length of the cutting edge of the blade, and having end portions which are intended to be bent transversely and maintained in a position of curvature during use, and whose medial parts are substantially softer than the cutting edges.

With known methods of producing such blades it is difficult to obtain the desirable degree of hardness of the cutting edges, if the medial area is to be sufficiently soft to permit the blade to flex without risk of fracture. Moreover such prior methods are very liable to produce distortion of such blades so as to render it commercially impracticable to produce therefrom finished blades with an even cutting edge by grinding in the strip.

The object of the present invention is to facilitate obtaining differential hardening, and to enable the manufacturer to obtain more easily such different conditions of edge and medial hardness as he may desire.

What are the optimum conditions is to some extent a matter of opinion. It has been found that a blade with an edge hardness of about 850 on the Vickers hardness testing machine and a hardness of 650 or less near the medial projections gives good results in practice, but it should be observed that with these blades it is a matter of great difficulty to obtain exact figures.

The new process is characterized by the employment of an electric current in connection with a blade of such configuration and proportion that there is a substantial difference between the density of the current flow in different portions of the blade, the greatest density of such flow being in the end portions where the metal should be of the lowest degree of hardness, and least density at and near the cutting edge, the heating effect at each point being proportional to I^2R, where I is the density of the current flow at such point and R the resistance.

To obtain this differential density the current is applied to a hardened blade having a medial slot of substantial length, and end portions so shaped that the breadth of metal available for the passage of the current through such end portions is substantially less than that so available in the medial portion of the blade, whereby the density of the current flow in such end portions is increased beyond that near the cutting edges.

The length of the slot has an important effect in producing this result as has also its terminal form. With a slot of substantially even breadth and the current entering and leaving at the ends of the blade the density of the current flow near the medial line of the blade will also tend to be somewhat greater than at or near the cutting edge, since the path from electrode to electrode is less near such medial line.

The process is applicable to blades of known shape, e. g., such as those shown in U. S. Letters Patent Nos. 1,869,327, 1,850,902 and 1,858,316 since the end portions of such blades possess the requisite qualities above described.

The method is applicable both to cases where blades are hardened and/or tempered in the strip, and where individual blades are hardened and/or tempered separately.

The present invention is particularly suited for continuous operation in cases where the blades are hardened and tempered in the strip, which after the punching operation consists of a series of blade blanks (*a*) having continuous slots (*b*), the blade blanks being joined end to end by narrower portions or necks (*c*) which are finally severed to leave substantially equal portions thereof on adjacent blades.

The process may be carried out by first subjecting the strip to any known hardening process and then subjecting it to the electrical treatment by which the blade is tempered so as to give the desired edge hardness and the less hardened end portions simultaneously.

Owing to the fact that the end portions of the blade at which the current enters and leaves are of less cross sectional area than the main portion of the blade the current density will be substantially greater at the end areas than along the main portion of the blade, whereby such a differential tempering is obtained between the end areas and the main portion of the blade as will give the blade the characteristics hereinbefore referred to.

In order that the invention may be the more readily understood reference is hereinafter made to the accompanying drawing, in which:—

Fig. 1 is a diagrammatic view of one form of apparatus for carrying out the present process, and

Fig. 2 shows part of a strip of blade blanks adapted to be treated by the process.

Referring to the drawing, the strip of blade blanks *a* after being hardened by passing through a hardening apparatus 1 is caused to bridge a gap in an electric circuit, so that with a blade having a longitudinal slot the current will divide into two parts between the successive necks.

For this purpose the strip passes to the electrical treatment apparatus comprising spaced

apart pairs of contact blocks 9, 9*a* and 10, 10*a*. The blocks are held to the strip by light spring pressure so that they form yielding clamp contacts. The blocks 10, 10*a* are water cooled, a part of the water cooling system being indicated by 11. The water in the blocks 9, 9*a* is preferably insulated from the contacts.

The blocks 9, 9*a* and 10, 10*a* are units in an open circuit 11*a*, having therein a variable resistance 12, a single pole switch 13, an ammeter 14, and the secondary winding 15 of a transformer, the primary winding 16 being connected to the mains by a double pole switch 17. 18 is a voltmeter connected across the circuit 11. The circuit 11 is closed by that part of the strip which for the time being bridges the gap between the contact blocks 9, 9*a* and 10, 10*a*.

A working example of voltage and amperage for a strip in which the blades are proportioned as shown each blade being about 43 mm. long is 20 volts, 40 amps., with 40 blades between the contacts, the speed of strip going through being 200 blades a minute.

The strength of the current is so chosen with respect to the rate of feed of the strip, and the distance the contacts are spaced apart, that in the time that the blade is subject to the heating effect of the current the necks *c* are softened the desired amount, while reducing the edge hardness of the strip to that desired.

By the present invention the following factors are under the manufacturers' control; the hardness of the blade before treatment, the strength of the current, the time during which it is applied, the width of the end portions through which the current enters and leaves and the minimum breadth of metal available for the path of the current near the ends compared to that of other portions of the blade, and by experiment or calculation these factors can be so varied as to obtain a great variety of differences of temper.

Further, where the current is applied to a strip containing a number of blades, the differentiation of current density may be increased by nicking or the like, so that the breadth of the parts by which the current enters or through which it flows is decreased. Nicks *d* at the necks between the blades are shown in Fig. 2.

Apart from the specific advantages above described the use of the electric current avoids many of the difficulties attached to other methods of tempering.

What I claim is:—

1. Process for the production of thin flexible razor blades with high edge hardness and relatively softer medial end areas, comprising applying an electric current to a hardened blade having a medial slot of substantial length, the cross sectional area of the end portions of such blade being substantially less than that of the intermediate portion so that the density of the current is substantially greater over the medial end portions than at or near the cutting edges.

2. Process for the production of thin flexible razor blades with high edge hardness and relatively softer medial end areas, which comprises applying an electric current to a hardened strip of blades which are provided with a longitudinal slot of substantial length, the portions of such strip between the slots being of substantially less cross sectional area than that of the remaining part of the strip so that the density of the current is substantially greater over the medial end portions of the blades than at or near the cutting edges.

3. Process for the production of thin flexible razor blades with a high edge hardness and relatively softer medial end areas, comprising applying an electric current to a plurality of hardened blades which are provided with a longitudinal slot of substantial length and are each connected longitudinally in strip form by necks of substantially less cross-sectional area than the main portion of the blade so that the density of the current will be substantially greater over the medial end portions of the blades than at or near the cutting edges.

4. Process for the production of thin flexible razor blades with a high edge hardness and relatively softer medial end areas, which consists in hardening a plurality of blades which are each provided with a longitudinal slot of substantial length and are connected longitudinally in strip form by necks of substantially less cross-sectional area than the main portion of the blade, and then applying an electric current to such strip so as simultaneously to temper the blades and to reduce to a greater extent the hardness of the necks by the differential current density set up along the strip.

5. Process for the production of thin flexible razor blades with a high edge hardness and relatively softer medial end areas, comprising applying an electric current to a plurality of hardened blades which are each provided with a longitudinal slot of substantial length and are connected longitudinally in strip form by necks of substantially less cross-sectional area than the main portion of the blade so that the density of the current will be substantially greater over the medial end portions of the blades than at or near the cutting edges, the said current entering and leaving through externally cooled electrodes.

6. Process for the production of thin flexible razor blades with high edge hardness and relatively softer medial end areas, comprising hardening a blade having a medial slot of substantial length and then applying an electric current to the blade so as simultaneously to temper the blade at or near the cutting edges and reduce to a greater extent the hardness of the medial end areas of the blade, the cross-sectional areas of the end portions of such blade being substantially less than that of the cutting portion so that the density of the current is substantially greater over the medial end areas than at or near the cutting edges.

7. Process for the production of thin flexible razor blades with high edge hardness and relatively softer medial end areas, comprising applying an electric current to a hardened blade having a medial slot of substantial length, the cross-sectional area of each end portion of such blade being substantially less than the combined cross-sectional area of the cutting-edge-bearing portions so that the density of the current is substantially greater over the medial end portions than at or near the cutting edges.

OTTO ROTH.