Sept. 12, 1933. A. R. STARGARDTER 1,926,861

FINE EDGED BLADES AND METHOD OF MAKING THE SAME

Filed March 10, 1933

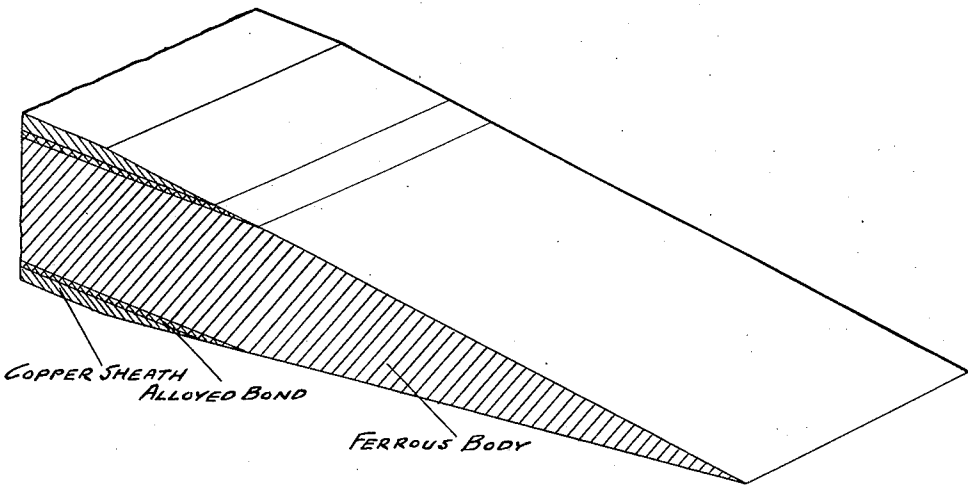


Fig:1.

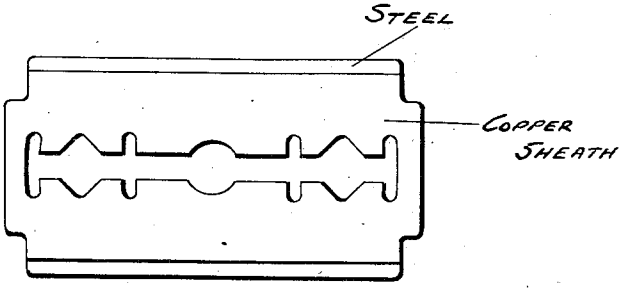


Fig:2.

INVENTOR.
Albert R. Stargardter.
by H. H. Kenway. Atty.

Patented Sept. 12, 1933

1,926,861

UNITED STATES PATENT OFFICE

1,926,861

FINE EDGED BLADES AND METHOD OF MAKING THE SAME

Albert R. Stargardter, Brookline, Mass., assignor to Gillette Safety Razor Company, Boston, Mass., a corporation of Delaware

Application March 10, 1933. Serial No. 660,233

5 Claims. (Cl. 76—104)

This invention relates to fine edged blades and, while it may be usefully embodied in cutting implements of general utility, it has a particularly useful field in connection with safety razor blades of the thin, flexible type which are adapted for use in holders wherein they are clamped for support.

In a broad aspect, my invention consists in a blade comprising a tempered ferrous body having a non-ferrous metal sheath united thereto by a bond of said metals interalloyed in an intermediate zone. I have discovered that blades thus characterized possess many striking advantages in respect to durability in service, appearance, and convenience and economy of manufacture. Some of these will be pointed out hereinafter.

It has been known heretofore that a steel ingot may be enclosed in and integrally bonded to a non-ferrous metal envelope, such as copper, and then rolled into sheet form to present a copper sheathed product in which the copper is integrally united to the steel, the copper actually entering into the body of the steel and forming a zone of alloy therewith. In the rolling operation, this bond remains intact and the copper coating or sheath is reduced in thickness in approximately the same proportion as the steel of the ingot is reduced in thickness. The copper sheath thus formed is integrally or metallurgically united to the steel body and, in this respect, is to be distinguished from a plated structure wherein a non-ferrous coating is electrolytically applied to the surface of the metal of a blank or base. There are serious limitations to plated constructions which render them unsuitable for cutting implements. For example, electro deposits can not be applied to a ferrous base before hardening, since in the heat of the hardening operation electro-plated surfaces are seriously impaired. Accordingly, electro-deposition can be applied only after hardening and is of no effect, of course, in reducing the hardening strains in the product. Further, electro-deposition does not make the blades entirely rutstproof because corrosion and electrolytic action is set up between the electro-deposited film and the ferrous body of the implement. This is apparent on the plated surface and extends, to some extent, to the sharpened edge of the implement. An electro-plated film, moreover, is not in all cases permanently bonded to a ferrous base but is likely to peel off, particularly when a portion thereof is removed by grinding or otherwise.

An important advantage incident to the use of a copper-clad steel for fine edges is that, since the thermal conductivity of copper is considerably greater than steel, the bimetallic blank may be hardened and tempered with greater efficiency than the blank of solid steel. This will be apparent when it is considered that, in a copper sheathed blank, steel is replaced by copper in those parts of the structure where hardness and temper are not required, that is to say, in the surface portion of the blank, whereas the sharpened and beveled portion of the blank in which the cutting edge is formed is comprised entirely of steel to which the hardening and tempering operation is confined.

A further advantage is that the finished blade is relieved completely of residual strain in its surface portions. Since these portions comprise copper, they are substantially unaffected by the hardening and tempering operations and no initial strain is developed in them. The blade, therefore, tends to lie flat without warping or twisting and the soft outside layer of copper acts as a cushion, making the blade more durable and better adapted to stand repeated flexing in use without breakage.

The use of a copper-clad steel for fine edged blades also presents the advantage of a rustproof product, with none of the disadvantages of a plated product in respect to electrolytic corrosion, or tendency to peel. This advantage is particularly noticeable in connection with safety razors of the type in which the blade is sharpened while retained in the razor, as in the Auto Strop type of safety razor. Heretofore, such blades have been subject to objectionable rusting since they are not always removed and dried after use, but may remain in the razor for a long time, being sharpened repeatedly in the meantime.

Fine edged blades of my invention present the further advantage of an attractive surface finish and thus eliminate the necessity for polishing operations of more than slight extent because the surface of the copper sheath has a cold-rolled surface finish imparted to it which is essentially smooth and which requires no more than a buffing or brightening operation in order to be brought to a high degree of lustre.

These and other features of my invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawing in which,

Fig. 1 is a perspective view, partly in section, of a portion of a blade on a greatly magnified scale, and

Fig. 2 is a plan view of one type of safety razor blade in which the invention may be embodied to advantage.

In manufacturing a safety razor blade of the type illustrated, I employ copper-clad steel in sheet form, rolled to an overall thickness of .0060". One satisfactory steel for this purpose contains 1.20% carbon and 0.2% chromium. As suggested in Fig. 1, the steel or ferrous body of the blade is reduced to a thickness of approximately .0048". The copper sheath, comprising the opposite surfaces of the blade, is approximately .0005" and the alloyed bond, which is partly steel and partly copper, comprises approximately .0001" in thickness. It will be understood that the ferrous and non-ferrous metals are mechanically intermingled or interalloyed in the intermediate zone of the bond, the copper content of the alloy decreasing inwardly from the sheath, and the ferrous content of the alloy decreasing outwardly from the ferrous body.

Having blanked out the blade, it may be now hardened and tempered in accordance with any desired commercial method, as, for example, that disclosed in my co-pending application, Serial No. 561,183, filed September 4, 1931. As therein shown, the blade stock is handled in strip form and after the individual blanks have been outlined in the strip, the strip is conducted continuously through an electric heating furnace, and then progressively quenched and hardened. It is then advanced through an electrically heated drawing furnace where it is drawn to the temper best adapting it for its intended purposes.

In sharpening such a hardened and tempered blank in the manufacture of safety razor blades, the edge or edges thereof are ground to a bevel of substantially 10° in included angle. In this process, the copper sheath and the alloyed bond are removed at the thick end of the bevel and the ferrous body is exposed for a substantial distance beyond it to the cutting edge of the blade, as clearly shown in Fig. 1.

As already intimated, the greater thermal conductivity of the copper sheath of the strip very favorably affects the efficiency or susceptibility of the encased steel to the hardening and tempering changes of temperature to which it is subjected, as compared with a solid steel strip. The steel, it will be understood, is hardened and tempered through its copper sheath.

Another important advantage incident to the bimetallic strip method of manufacture is that the non-ferrous surface of the strip obviates the necessity for lubrication of the surfaces to inhibit staining or corrosion between the stages of processing. Heretofore, it has been necessary to apply oil or grease to the surface of a steel strip at several stations throughout the manufacturing process to prevent contamination leading to corrosion at these intervals and then to remove such grease at other stations, prior to such operation as that of marking the blanks, for example.

Having hardened and tempered the copper-clad strip, as above outlined, the process of blade manufacture may be continued without modification from that practiced heretofore, except for the elimination of polishing, greasing and degreasing as set forth above and in the final step, the complete tempered and sharpened blades are broken off one by one from the end of the strip.

A blade such as may be produced by the process above outlined is shown in Fig. 2. It is sharpened at its opposite longitudinal edges so that the copper sheath is limited to the surface portions between the beveled edges. The body of the blade is provided with an elongated slot of substantially the same length as the cutting edges, having local enlargements of special arrangement designed to position the blade in co-operation with the blade-locating projections of the safety razor in which it is to be used. The blade thus formed is provided with an integrally bonded copper sheath covering the entire surface of the blade up to the line of bevel, protecting it against rust, furnishing a tough and ductile surface cushion which has no tendency to set up electrolytic action between itself and the steel body of the blade, or between itself and the non-ferrous material usually employed in safety razors.

The copper sheath itself has no initial strains imposed upon it in the hardening and tempering operations and also tends to relieve and absorb initial strains in the blade as a whole by confining them to the interior of the blade, that is, to the ferrous core thereof. In other words, such strains as are incident to hardening and tempering are prevented from reaching the surface portions of the blade.

In my safety razors, the blade is flexed and maintained in a position of pronounced transverse curvature by being bent over fulcrum shoulder. This tends to localize bending strains in the blade at the very place where electrolytic action between the blade and the holder is most likely to occur, since, when the conventional all-steel blade is subjected to a straight-line contact with the supporting fulcrum of the razor holder which is composed of a non-ferrous metal, electrolytic action is set up between the steel surfaces of the conventional blade and the non-ferrous contacting surface of the holder. This results in corrosion of the steel blade surface along this line of contact between blade and holder, which is entirely absent in the bimetallic blade, having a non-ferrous surface. By eliminating this action, the blades of my invention are rendered less susceptible to the breakage heretofore encountered in safety razors of this type.

I have referred herein to copper as an example of one suitable material for the sheath, but other non-ferrous metals would be entirely suitable and may be employed as desired. For example, aluminum has been found satisfactory in many cases and may be used where a silver-colored finish is desired. I wish, therefore, to include within the scope of my invention any non-ferrous metal capable of forming an interalloyed bond with a ferrous base.

My invention also includes within its scope the novel method of making fine edge blades herein disclosed, as well as the new article of manufacture, viz., the hardened and tempered bimetallic blade stock herein disclosed as produced by the preliminary steps of the method.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is,

1. A thin flexible blade comprising a ferrous body having a surface sheath of non-ferrous metal united thereto by a bonding layer of said metals mechanically intermingled and coextensive with the sheath, the ferrous body being tempered and sharpened to a cutting edge which extends beyond the sheath.

2. A thin flexible safety razor blade comprising a hardened and tempered body of sheet steel having a thin layer of copper integrally bonded to its opposite surfaces by bonding layers of copper and

steel mechanically intermingled and constituting ductile portions of high thermal conductivity, free of hardening stress, and cutting edges disposed outside said surface layers of copper in the tempered body of the blade.

3. A method of making safety razor blades, which consists in bonding a non-ferrous envelope to a steel body, rolling the composite body into a sheet having a thin non-ferrous sheath thereon of high thermal conductivity, hardening and tempering the sheathed sheet, and then grinding one edge to remove the sheath and form a cutting edge in the steel body.

4. A method of making fine edged blades, which consists in bonding a copper envelope to a steel body, rolling the composite body into a sheet having a thin copper sheath of high thermal conductivity upon its opposite surfaces, tempering the copper sheathed sheet leaving the sheath intact thereon as a relatively soft rustproof cushion free of initial stress, and then grinding one edge to expose a tempered steel cutting edge.

5. A thin flexible safety razor blade of standard thickness comprising a steel center portion sharpened at its edge, and thinner surface portions of a softer non-ferrous metal of higher heat conductivity bonded thereto by layers of the two metals mechanically intermingled, the steel being hardened and tempered through the surface portions which thus serve as flexible stress-free integral cushions for the tempered center portion of the blade.

ALBERT R. STARGARDTER.