Sept. 21, 1937. A. R. STARGARDTER 2,093,874

FINE EDGED BLADE AND METHOD OF MAKING THE SAME

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Fig. 1.

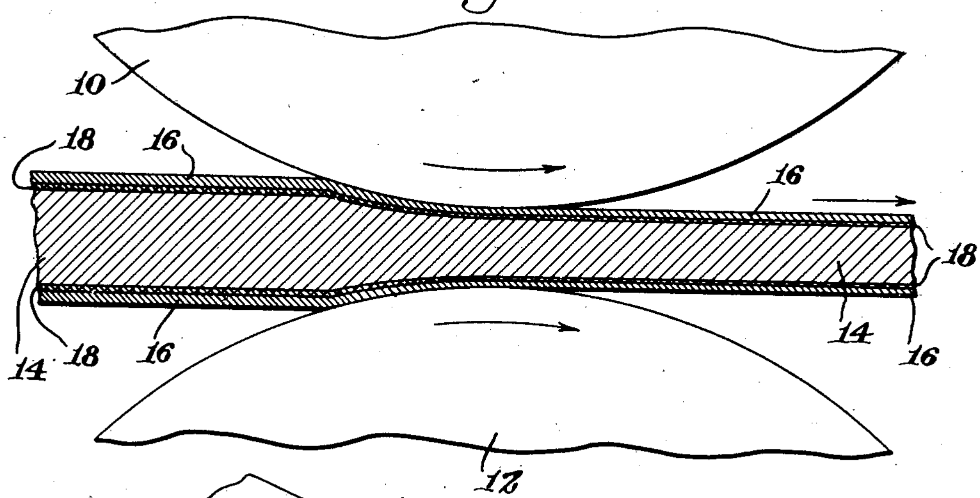


Fig. 2.

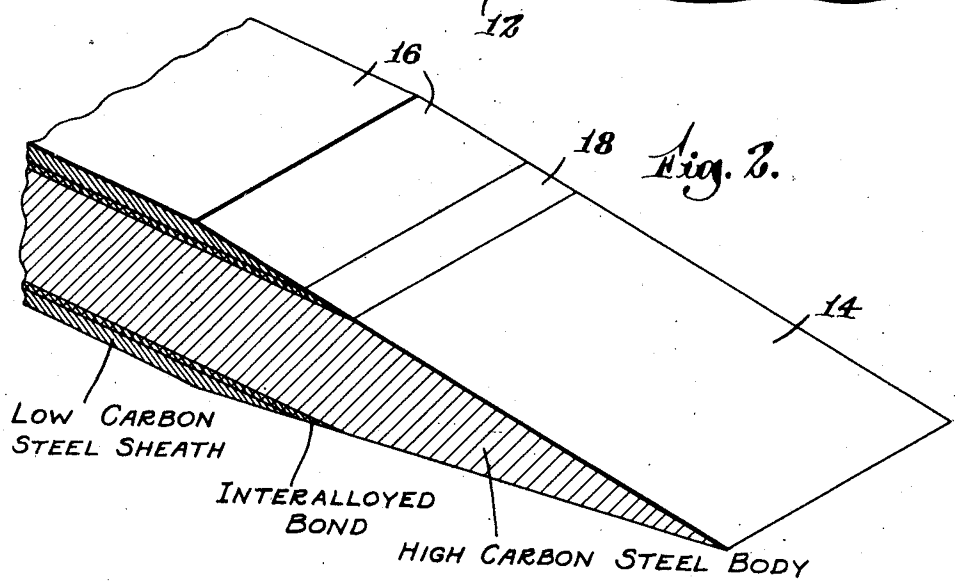
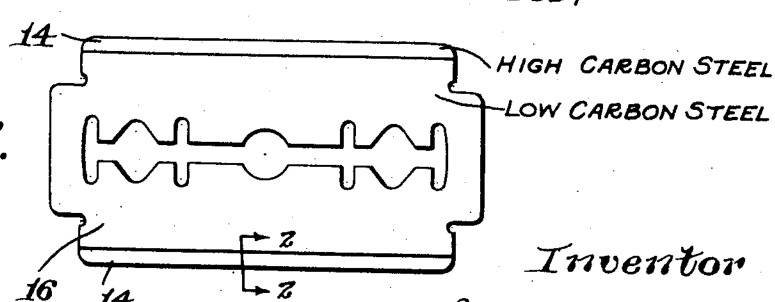


Fig. 3.



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FINE EDGED BLADE AND METHOD OF MAKING THE SAME

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Application September 11, 1935, Serial No. 40,030
Renewed April 23, 1937

4 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 field of particular use in connection with safety razor blades of the thin flexible type which are adapted for use in holders wherein they are transversely flexed and clamped for support.

In one aspect my invention consists in a blade comprising a tempered body of high carbon steel having a sheath of low carbon steel united thereto by a bond of the said metals interalloyed in an intermediate zone. Blades of this structure possess the striking advantage that they present a cutting edge of unusual hardness in a blade which is not as a whole objectionably brittle. They may also be manufactured conveniently and at low cost.

It has been found that a high carbon steel ingot may be enclosed in and integrally bonded to a low carbon steel envelope and then rolled into sheet form presenting a sheathed product in which the low carbon steel is integrally united to the high carbon steel, actually entering into the body of the latter and forming a zone of alloy therewith. In the rolling operation this bond remains intact and the low carbon steel sheath is reduced in thickness in approximately the same proportion as the steel of the ingot. The low carbon steel sheath thus formed is integrally or metallurgically united to the high carbon steel body and the composite sheet may be worked as an integral piece of material although its components have different characteristics and respond differently to heat-treatment. For example, when subjected to a hardening and tempering operation the low carbon steel sheath will attain a slight resiliency and yet, by reason of its ductile character will absorb the hardening stresses, thus permitting the high carbon steel core to be hardened to a degree not hitherto practical; that is, the core of the bimetallic blank may be hardened to a degree which would render the blade too brittle in use if brought uniformly to that degree of hardness. At the same time the low carbon steel sheath retains an appreciable amount of the resiliency imparted to it in the hardening operation so that the blade as a whole is sufficiently resilient to resume its normal flat condition after the flexing to which it may be subjected in normal use or handling.

In combining high carbon and low carbon steels in the manner above outlined a particularly secure interalloyed bond is formed between the two metals and this is not impaired by the process of hot rolling to which the composite sheet is first subjected. Hot rolling may be carried out at temperatures between 1800 and 1950 degrees F. which is not far beyond the melting point of copper or other non-ferrous metals. In hot rolling a steel sheathed sheet of high carbon steel there is no tendency of the component parts to separate at the line of their interalloyed bond or to blister from each other on account of any heat likely to be encountered in hot rolling processes. Neither is there any tendency of these metals to tear apart in the ensuing cold rolling operations. On this account manufacturing waste is reduced to a minimum and good economy of blade manufacture insured.

These and other features of the 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 fragmentary view suggesting the hot rolling process to which the composite sheet is subjected;

Fig. 2 is a view in perspective, partly in section, of a portion of a blade on a greatly magnified scale;

Fig. 3 is a plan view of one type of safety razor blade which may be produced by the method of the present invention.

In manufacturing a safety razor blade of the type illustrated I employ a composite sheet of high carbon and low carbon steel in sheet form, rolled to an overall thickness .0060″. One satisfactory high carbon steel for this purpose contains 1.20% carbon and 0.2% chromium. As suggested in Fig. 2 the high carbon steel body of the blade is reduced in this material to a thickness of approximately .0048″. The low carbon steel sheath which constitutes the outer surface of the blade is approximately .0005″ in thickness and the alloyed bond which is made up of the intermixed steels comprises approximately .0001″ in thickness. It will be understood that the high carbon and low carbon steels are mechanically intermingled or interalloyed in the intermediate zone of the bond. The low carbon steel content of the alloy decreases inwardly from the sheath and the high carbon steel content of the alloy is diluted outwardly from the body or core of the blade.

In Fig. 1 is suggested the operation of hot rolling the sheathed ingot to convert it to sheet form. The rolls 10 and 12 engage the work under heavy pressure, advancing it and at the same time reducing its thickness and elongating it. The high carbon or razor steel body 14 is shown as enclosed by a sheath of mild or low carbon steel 16 and the two metals are bonded together by an intermediate interalloyed zone 18. The sheathed ingot is first reduced by the draft of the rolls in a hot rolling process and the resulting sheet is subsequently reduced by cold rolling to the desired thickness of .006''. As already intimated, the interalloyed bond is not adversely affected in any way, either by overheating in the hot rolling process or by tearing of the metal in the cold rolling process.

Having blanked out the blade or blade strip from the sheathed sheet, it may now be hardened and tempered in accordance with any preferred 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 adapted for its intended purpose.

In harpening such a hardened and tempered strip or blank in the manufacture of safety razor blades the edge or edges thereof are ground to a bevel of substantially 10° in the included angle. In this process the low carbon sheath 16 and the alloyed bond 18 are removed at the inner end of the bevel and the high carbon steel body is exposed for a substantial distance to the cutting edge of the blade, as clearly shown in Fig. 2.

The tempering operation may be carried out in connection with the blade of my invention at a temperature which will leave the high carbon steel body of the blade relatively hard, that is to say, harder than it has been hitherto considered practicable to harden safety razor blades. For example, the hardness of the body portion may be 900 Vickers hardness scale. The low carbon steel sheath, however, is but slightly hardened in the hardening operation and may remain at about 450 Vickers hardness scale. The steel sheath, however, retains an appreciable natural resiliency imparted to it in the hardening process so that it is not merely an inert envelope for the tempered body but tends of its own accord to reassume a normal flat condition after being flexed and to assist the blade as a whole in retaining a normal flat condition. On the other hand, the low carbon steel sheath is sufficiently ductile to absorb the strains of the hardening operation, thus freeing the fully hardened interior edge-forming portion of the blade from retained stress. The steel sheath, moreover, is of appreciable tensile strength and toughness. The result is that the more fully hardened body portion 14 of the blade is safeguarded and reinforced and that the aggregate result is a composite steel blade sufficiently tough to withstand breakage, sufficiently resilient to retain a normal flat condition and yet having extreme edge hardness and the resulting most desirable edge-holding properties which are highly prized in cutting implements in general and razor blades in particular.

Having hardened and tempered the steel clad strip as above outlined, the process of blade manufacture may be carried forward without modification from that commercially practiced heretofore, the complete tempered and hardened blades being broken off one by one from the end of the tempered strip.

A blade such as produced by the method above outlined is shown in Fig. 3. It is sharpened at its opposite longitudinal edges so that the low carbon steel sheath is limited to the surface portion between the bevelled edges of the blade. The body of the blade is provided with an elongated slot of substantially the same length as the cutting edges and the slot has local enlargements 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 steel sheath covering the entire surface of the blade up to the line of bevel and furnishing a tough and ductile surface cushion which has no tendency to set up electrolytic action between itself and the high carbon steel body of the blade.

The low carbon steel sheath itself has no initial strains imposed upon it in the hardening and tempering operation and it also tends to relieve and absorb initial strains in the blade as a whole.

In many safety razors the blade is flexed and maintained in a position of pronounced transverse curvature by the shape of cap and guard members. It is generally desired, however, that the blade should spring back to flat condition when released from the razor, not taking the set of its transverse curvature. The appreciable resiliency imparted to the low carbon steel sheath in the cold rolling operation is effective to a very desirable degree in contributing to this result.

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 safety razor blade comprising a hardened and tempered body of high carbon sheet steel having a thin layer of low carbon steel integrally united to its opposite sides by bonding layers of the two steels intermingled and constituting slightly resilient surface portions substantially free of hardening stress, and cutting edges disposed in the tempered body of the blade outside said surface layers of low carbon steel.

2. A method of making fine edged blades, which consists in bonding a low carbon steel envelope to a high carbon steel body, rolling the composite body into a sheet having a thin low carbon steel sheath upon its opposite surfaces, tempering the sheathed sheet in a manner leaving the sheath intact thereon as a relatively soft and slightly resilient cushion substantially free of initial stress, and then grinding the low carbon sheath to expose a tempered cutting edge of high carbon steel.

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

4. A flexible blade comprising a body of high carbon steel heat treated and thereby rendered hard and having a cutting edge formed therein, and a sheath of low carbon steel integrally united to its opposite sides by a continuous bond of the two steels interalloyed, the sheath terminating short of said cutting edge, being substantially free of hardening strains, tending by its resiliency to maintain the blade in a flat condition and by its inherent toughness to prevent breakage of the blade.

ALBERT R. STARGARDTER.