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2,395,878

METHOD OF MAKING BIMETALLIC BILLETS

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Fig. 1.

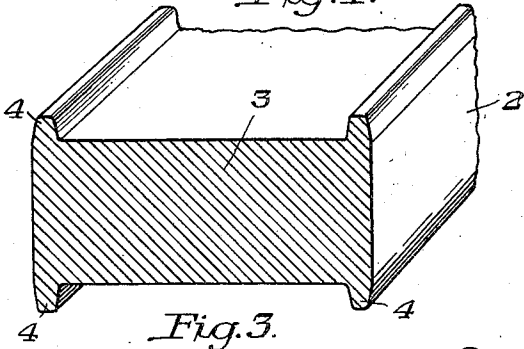


Fig. 2.

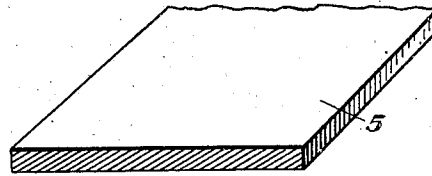


Fig. 3.

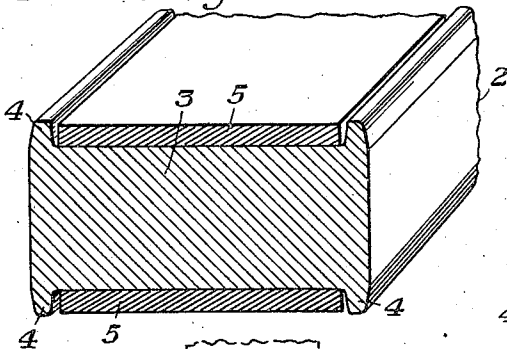


Fig. 4.

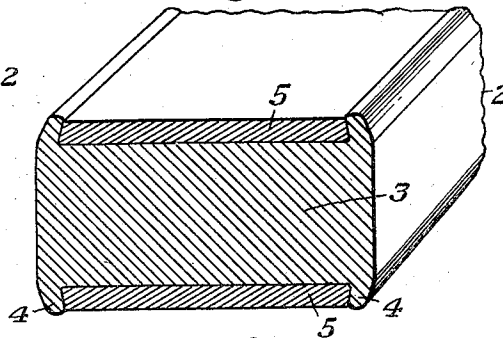
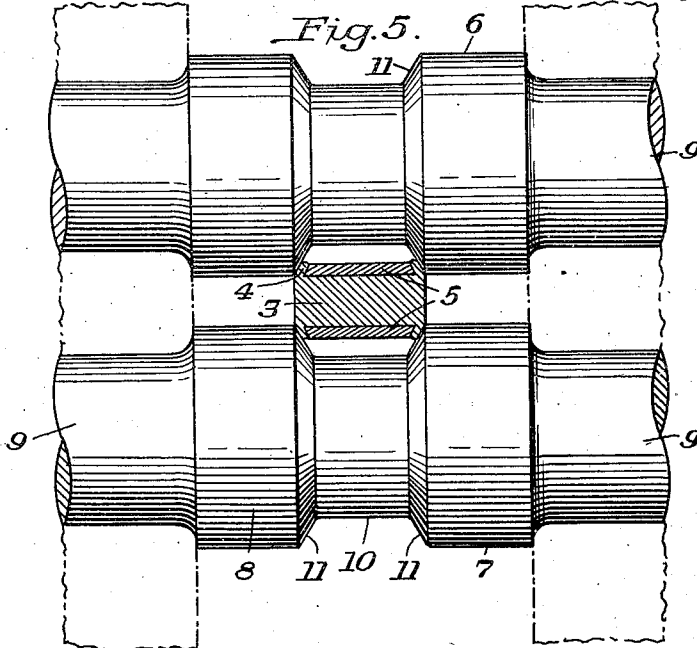


Fig. 5.



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UNITED STATES PATENT OFFICE

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METHOD OF MAKING BIMETALLIC
BILLETS

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3 Claims. (Cl. 29—188)

This invention relates to the method of making bimetallic billets. It relates more particularly to bimetallic billets comprising a ferrous metal component and at least one dissimilar metal component, which billets are adapted to be rolled to produce bimetallic strip, and the making of such billets. Such strip may be used for many purposes, including the formation of deformed metal shapes, examples of which are ammunition components such as bullet jacket cups and cartridge cases. Herein the word "billet" is used generically to include billets adapted to be rolled into sheet form metal of great length and bars adapted to be rolled into sheets, and the word "strip" is used generically to include any metal in strip or sheet form.

It has heretofore been proposed to make bimetallic billets having a component of ferrous metal and one or more components of dissimilar metal. Ordinarily the ferrous metal component is relatively thick and serves as the backing and the dissimilar metal component or components is or are relatively thin and serve as the facing. While the present invention in its broadest aspects is not limited thereto, it will be described by way of illustration in connection with the making of bimetallic billets comprising a ferrous metal backing component and two dissimilar metal facing components disposed at opposite faces of the backing component.

In the making of bimetallic billets of the type above referred to it is important that air be not entrapped between the components of the billet during hot rolling as such air forms oxides between the components of the billet interfering with their proper union. Heretofore great difficulty has been encountered in avoiding such air entrapment, various proposals having been made to solve the problem but without entire success. It has been proposed to weld the billet components to each other completely around the periphery of the billet. This provision, however, is unsatisfactory because of its great cost and because of the likelihood of imperfect welding. Moreover, even if a perfect weld could be obtained it is difficult to insure that all air has been removed from between the billet components at the time of welding. Efforts have been made to reduce the cost incident to welding completely around the periphery of the billet by providing the backing component with opposed flanges between which the facing component is positioned and which flanges are adapted to be deformed against the facing component to hold it in place and to seal the longitudinal edges of

the billet. When this has been done the ends of the billet have been welded to seal them. Prior to the present invention it has always, so far as I am aware, been considered necessary to weld together at least the ends of the components of a bimetallic billet in order to prevent formation of oxides between the layers during hot rolling. Even welding of the ends alone has drawbacks in addition to the cost of welding, one of which is that the welds at the ends do not hold during hot rolling but break due to the action of the rolls and the tendency of the components to differentially elongate. Moreover, even with the greatest care satisfactory results in the rolling of bimetallic billets the components of which were welded together could not be relied on, oxides and blisters being formed between the layers.

I have discovered how to make a bimetallic billet comprising a ferrous metal or like component and one or more dissimilar metal components which can be rolled with entire success without the necessity of any welding of the billet components to each other in formation of the billet. I have found that the degree of softness of the second mentioned metal component or components is an important factor and that if such component or components is or are soft enough a bimetallic billet may be formed without any welding together of the billet components during formation thereof and will roll with entire satisfaction and without the formation of oxides or blisters between the layers. Heretofore so far as I am aware it has been the practice to employ as the facing component in the making of bimetallic billets a metal which has been cold rolled after annealing. Such rolling increases the hardness and reduces the ductility of the metal to some extent. I believe that there has been a tendency of the facing metal due to its lack of requisite softness and ductility to bow or bridge during fastening together of the longitudinal edges of the backing and facing. This has been definitely noticeable when a flanged backing has been used and the flanges of the backing have been deformed against the longitudinal edges of the facing to hold the facing in place. Such deformation of the backing flanges tends to exert lateral pressure on the facing and such pressure, due to the fact that the facing is stiff to some extent, results in slight separation of the central portion of the facing and the central portion of the backing, considered transversely of the billet.

I have found that the bowing or bridging tendency of the facing can be eliminated or sufficiently

counteracted to avoid unsatisfactory results in rolling by the employment of a softer component than has heretofore been employed. I have found that the facing component should have a hardness not substantially greater than Rockwell B60. For example, I have made bimetallic billets comprising a backing of low carbon steel and a facing of gilding metal (copper in the neighborhood of 90% and zinc in the neighborhood of 10%) with the gilding metal at or somewhat below a hardness of Rockwell B60 without welding together the ends of the backing and facing and the results in rolling have been entirely satisfactory. Attempts to do the same thing with a gilding metal facing having a hardness substantially greater than Rockwell B60 have resulted in the formation of oxide between the layers during hot rolling. While I am not certain as to the theory of action and make no representations with respect thereto, I believe that when the facing metal has a hardness not substantially greater than Rockwell B60 it is sufficiently soft, pliable and ductile that it does not have a sufficient tendency to bow or bridge transversely during formation of the billet to admit air, at least in such quantities as to result in oxide formation between the layers during hot rolling. I also believe that it is definitely advantageous to leave the ends of the billet components unwelded to each other when the billet is formed, as I believe that any small quantities of air which may repose between the components during billet formation are rolled out at the ends of the billet early in the rolling. While every trace of air may not be rolled out when welding is omitted, the oxygen in any air remaining is insufficient to form harmful oxides. When the ends of the billet are welded this is not possible and any air entrapped between the components of the billet is prevented from escaping and forms oxides. Even if the weld breaks during rolling the damage is likely to have occurred prior to such breakage. Moreover, if facing metal having a hardness substantially greater than Rockwell B60 is employed which tends to rise up from the backing along the longitudinal center line of the facing I believe that the fact that a relatively great quantity of air may thus enter between the billet components results in undesirable oxidation before such relatively great quantity of air can be rolled out at the ends of the billet.

As above stated, I am not certain as to the theory of action but I have found that when the hardness of the relatively soft metal component of a bimetallic billet does not substantially exceed Rockwell B60 I obtain entirely satisfactory results in rolling whereas with harder facing material I do not. I find it highly desirable to employ a dead soft facing material. For best results the facing material should be annealed at its final thickness and not rolled after such anneal. It should be applied to the backing in formation of the bimetallic billet in its state as annealed.

I have also found that when a flanged backing is used and a facing having a hardness not substantially greater than Rockwell B60 is applied thereto between the flanges and the flanges are then deformed against the facing at the longitudinal edges of the billet best results are contributed to by deforming the flanges of the backing by rolling. That is, the backing and facing or facings are assembled with the facing or facings between opposed flanges of the backing and the thus assembled structure is then passed between rolls which are shaped to turn or bend the flanges inwardly and press them strongly against the

edges of the facing. While the feature of deforming the flanges by rolling is not per se new, I find that it cooperates with the utilization of a facing component having a hardness not substantially greater than Rockwell B60 to produce a bimetallic billet which is uniformly satisfactory. I believe that the deforming of the flanges of the backing against the edges of the facing by rolling accomplishes the result of firmly holding the billet components together without exerting such stresses on the facing as to result in material separation of it from the backing to admit air in such quantity as to result in formation of oxides between the layers during hot rolling. In any event, I find that when a flanged backing is employed and a soft metal facing having a hardness not substantially greater than Rockwell B60 is applied to the backing between opposed flanges and the flanges are deformed against the facing by rolling the billets give virtually 100% yield without the formation of oxides between the layers during rolling. Such a yield was never obtainable by a process of the type herein disclosed prior to adoption of the feature mentioned.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof and a present preferred method of practicing the same proceeds.

In the accompanying drawing I have shown a present preferred embodiment of the invention and have illustrated a present preferred method of practicing the same, in which

Figure 1 is a cross-sectioned perspective view of a flanged ferrous metal component of a bimetallic billet;

Figure 2 is a similar view of a facing component;

Figure 3 is a similar view of the component shown in Figure 1 and two components such as shown in Figure 2 assembled but before the components are fastened together;

Figure 4 is a view similar to Figure 3 but showing the components of the billet fastened together; and

Figure 5 is an elevational view of rolls for bending or turning inwardly the flanges of the ferrous metal component against the edges of the facing components to hold or fasten the components together, a bimetallic billet as shown in Figure 4, but to reduced scale, being shown between the rolls.

Referring now more particularly to the drawing, there is shown in Figure 1 the ferrous metal component of a bimetallic billet, such component being designated by reference numeral 2. It comprises a body 3 and four flanges each designated 4. As shown in Figure 1, the flanges 4 are arranged in pairs, two flanges at the top of the component projecting generally upwardly in opposed relationship at the side edges of the component and two flanges at the bottom of the component projecting generally downwardly in opposed relationship at the side edges of the component. Thus channels are formed at the upper and lower faces of the component 2, viewing Figure 1, for the reception of the facing components. It being understood that the billet to be formed is to have facing components top and bottom. A facing component is shown at 5 in Figure 2 and in Figure 3 the components 2 and 5 (there being two of the latter) are shown in assembled relationship but before being fastened together.

The component 2 is of ferrous metal, preferably steel. Ordinarily low carbon steel is used. It

may be formed by rolling, forging, milling or otherwise. It may be of any desired length. The facing components 5 are of dissimilar metal and as applied to the backing component 2 they have a hardness not substantially greater than Rockwell B60. I find that it is most satisfactory to render the facing components dead soft and in that condition apply them to the backing component in formation of the bimetallic billet. I prefer to anneal the facing components in their final thickness and employ them in their state as thus annealed for formation of the bimetallic billet. In the example illustrated the facing components 5 will be considered as being of gilding metal having a hardness of Rockwell B50. It is not difficult to provide gilding metal facing members of that degree of softness and ductility or even softer and more ductile.

After the facing components 5 have been applied to the backing component 2 as shown in Figure 3 the flanges 4 of the backing component are deformed or bent inwardly against the facing components to firmly hold them in place against the backing components. While such deforming of the flanges may be accomplished in various ways I find that best results are obtained when it is accomplished by rolling as presently to be described. However the deformation of the flanges is accomplished, the fact that the facing components 5 are of the degree of softness mentioned results in their lying substantially flat against the backing component despite the transverse forces acting thereon during deformation of the flanges. With the facing components as heretofore employed a definite tendency existed for such components to separate or bow or bridge up from the backing upon deformation of the flanges.

In Figure 5 I have shown rolls for deforming the flanges 4 of the backing against the facing components. There are shown upper and lower rolls 6 and 7, respectively, which are identical. Each roll has a body portion 8 and necks 9. The rolls are mounted in suitable housings. The body portion 8 of each roll is of reduced diameter at the central portion thereof so that a cylindrical portion 10 of substantially reduced diameter is formed, such cylindrical portion being joined to the unreduced part of the roll body 8 by conical surfaces 11. These conical surfaces 11 are the active portions of the rolls which act on the flanges of the billet component 2 to deform such flanges inwardly to hold the facing components 5 in place. The rolls are preferably driven and the assembled billet components, suitably held together, are presented to the rolls and passed therethrough, the conical portions 11 of the rolls deforming and turning inwardly the flanges 4 as shown in Figure 5. Such rolling action for deforming the flanges, when the facing components

5 are made of metal having a hardness not substantially greater than Rockwell B60, results in the formation of bimetallic billets with which uniformly excellent results in rolling when the billets are reduced to strip or sheet form are obtained.

While I have shown and described a present preferred embodiment of the invention and a present preferred method of practicing the same it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

I claim:

1. A method of making a bimetallic billet for rolling comprising providing a first metal component having opposed flanges and a second metal component having a hardness not substantially greater than Rockwell B60, disposing the second component in face-to-face contact with the first component and pressing the flanges of the first component generally in the plane of the second component laterally against the edges of the second component and thereby squeezing the second component between said flanges in its plane without bridging of the second component out of contact with the first component under pressure of said flanges against its edges.

2. A method of making a bimetallic billet for rolling comprising providing a first metal component having opposed flanges and a second metal component adapted to be joined thereto, annealing the second component to bring it into soft annealed condition, disposing the second component in face-to-face contact with the first component and pressing the flanges of the first component generally in the plane of the second component laterally against the edges of the second component and thereby squeezing the second component between said flanges in its plane without bridging of the second component out of contact with the first component under pressure of said flanges against its edges.

3. A method of making a bimetallic billet for rolling comprising providing a first metal component having opposed flanges and a second metal component adapted to be joined thereto, disposing the second component in face-to-face contact with the first component, pressing the flanges of the first component generally in the plane of the second component laterally against the edges of the second component, the second component being sufficiently soft that when the flanges of the first component press against its edges it is squeezed therebetween in its plane without bridging of the second component out of contact with the first component under pressure of said flanges against its edges, and so squeezing the second component.

WALTER L. KEENE.