

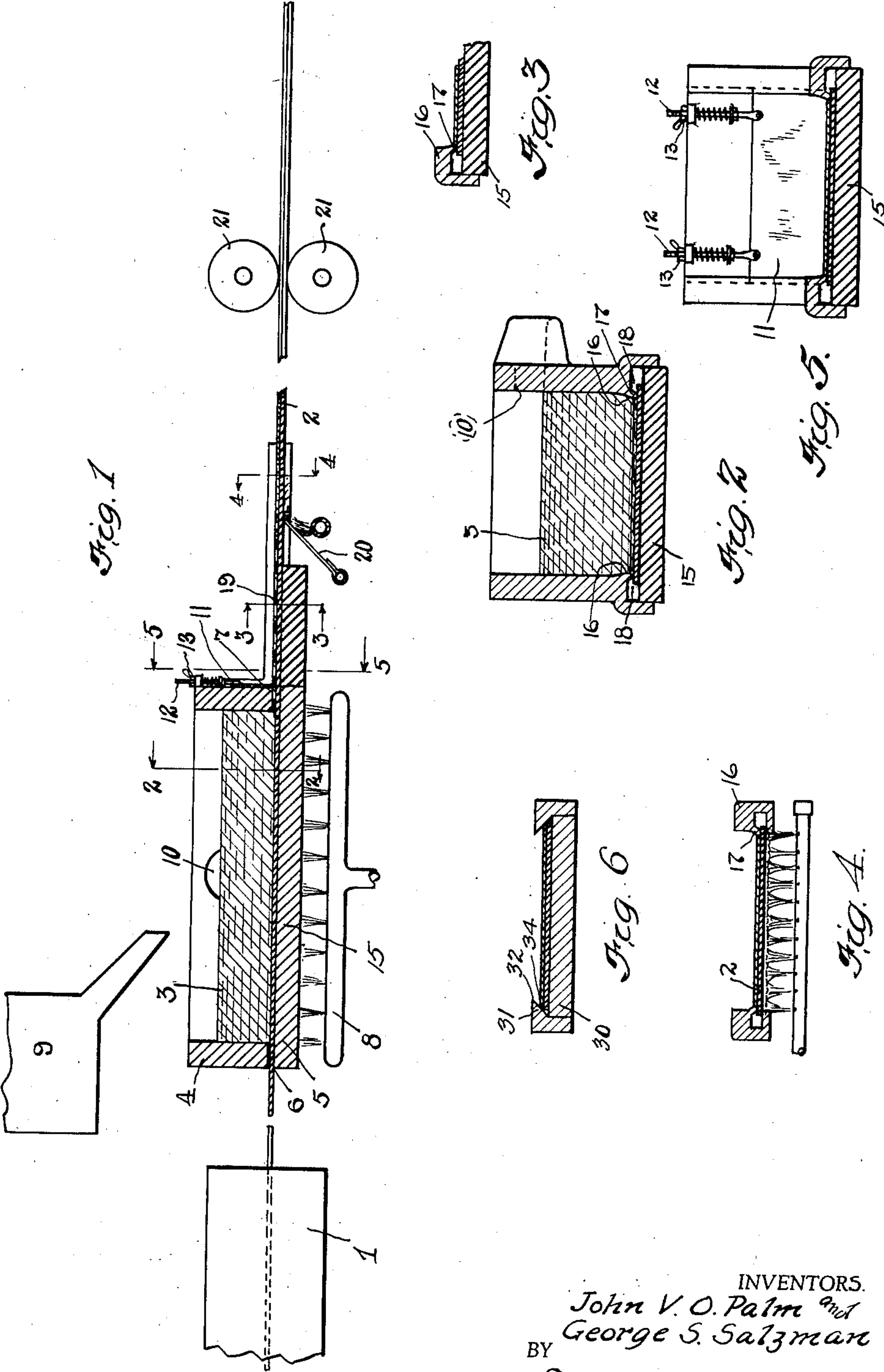
Nov. 26, 1935.

J. V. O. PALM ET AL

2,022,571

METHOD OF PRODUCING BIMETALLIC STRIPS

Filed March 3, 1933



INVENTORS.  
John V. O. Palm and  
George S. Salzmann  
BY  
Fay, Oberlin & Fay  
ATTORNEYS.



## UNITED STATES PATENT OFFICE

2,022,571

## METHOD OF PRODUCING BIMETALLIC STRIPS

John V. O. Palm and George S. Salzman, Cleveland Heights, Ohio, assignors to The Cleveland Graphite Bronze Company, Cleveland, Ohio, a corporation of Ohio

Application March 3, 1933, Serial No. 659,477

4 Claims. (Cl. 207—11)

The present invention, relating, as indicated, to a method of making bi-metallic strip, is more particularly directed to a method and apparatus for applying a coating of a metal of relatively low melting point, such for example as a bearing metal like babbitt, to one surface of a strip of metal of high melting point, such as steel. One of the principal objects of the invention is the provision of a simple and economical apparatus which may be operated continuously for the production of bi-metallic strip of the character described and which will be adapted to confining to a predetermined area on one of the surfaces of the strip of metal to be coated the softer metal to be applied thereto. A further object of the invention is the provision of means permitting a simple and accurate control of the coating of softer metal and securing the substantially instantaneous chilling of the coating when once applied in order to reduce grain growth and prevent improper crystalline structure of the softer metal.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawing and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:—

Fig. 1 is a side elevation more or less diagrammatic in character of one form of improved apparatus for carrying out the method hereinafter to be described; Fig. 2 is a transverse vertical section through the pouring box of Fig. 1; Fig. 3 is a similar section on the line 3—3, Fig. 1; Fig. 4 is a similar section on the line 4—4, Fig. 1; Fig. 5 is a partial section on the line 5—5, Fig. 1; and Fig. 6 is a similar section showing a modification of the guide means.

In the application of a metal of relatively low melting point, which for convenience will be hereinafter referred to either as bearing metal or as Babbitt, to a metal of a relatively high melting point, which for convenience we shall hereinafter term steel, numerous problems are presented which are not solved by the various methods heretofore suggested and described in certain prior patents and publications. One of the principal difficulties in the application of bearing metal to steel by any process involving flowing or flooding of the bearing metal onto one surface of a moving steel strip arises from the variable amount of bearing metal which becomes bonded on the steel,

and as a result the varying amounts of heat units caused to flow into the steel from the application thereto of varying amounts of bearing metal per unit of surface of steel. We have found that by accurately limiting the amount of surface of steel exposed to the molten bearing metal and by confining the contact between molten material and solid material to a predetermined portion of the surface area of the latter it is possible to successfully and continuously carry out the application of a coating of bearing metal to steel, and we have devised means for thus accurately limiting the effective contact between the two materials and defining the area of the steel strip to which the bearing material is applied. If the operation of flowing the bearing material onto the steel is thus accurately controlled, it is then possible to practically instantaneously "freeze" or solidify the molten material at a given point after the steel has left the bath of molten metal and to in this way prevent the increase in grain growth which is detrimental to the effectiveness of the babbitt as bearing material and to preserve a highly desirable physical structure in this material.

Referring now to the drawing, in Fig. 1 we have shown diagrammatically an apparatus designed to carry out our improved method. The apparatus consists of a heating chamber 1, through which there passes a strip of steel 2 of substantially uniform width and thickness, which then passes into a bath of molten bearing metal 3 confined within a chamber or pouring box 4. The chamber 4 is provided with imperforate sides and an imperforate bottom 5 but with an opening 6 at one end designed to permit the steel to pass therethrough, and with a second opening 7 at the exit end through which the steel and molten babbitt are drawn out of the bath. Any suitable heating means, such as a gaseous fuel burner 8, may be employed to apply heat to the pouring box 4 and to maintain the metal therein at the desired temperature. Molten metal is supplied to the bath 3 in an amount proportionate to the amount which is withdrawn in the form of coating on the strip 2. The new metal is supplied from a melting furnace 9 mounted and formed to discharge into the bath where a predetermined level is maintained by means of overflow openings 10 in the side walls at an appropriate height. It is necessary, in order to secure the application of an even and uniform coating of bearing metal to the steel to provide for a constant pressure or head in the Babbitt box, and we secure this by providing the overflow openings 10 and by currently passing into the bath a slightly greater



amount of metal than is withdrawn as coating, the balance overflowing through the openings 10. In this way the level in the box is maintained constant.

5 In order to regulate the depth of coating for different purposes the exit end wall 11 of the pouring box is movably mounted, the vertical position of this wall being controlled by adjusting screws 12 carried in a fixed support 13 extending  
10 across the top of the end wall or gate 11 and secured to the fixed sides of the box. Adjustment of the gate 11 may be had to vary the thickness of coating and to differentially vary the thickness from one side of the strip to the other.

15 Internally, the pouring box is formed with a flat bottom 15 upon which the strip is supported as it is drawn through the machine, and at the sides of the box are mounted guides 16 provided with narrow shoulders 17 positioned to engage  
20 snugly against the top of the strip 20. The latter is drawn through the box and the shoulders 17 thus blank off the edge portions 18 of the strip 2. These shoulders or guides 17 confine the contact between the pouring metal and the strip to a  
25 certain predetermined portion of the area of the upper surface of the strip passing through the box, prevent the flow of molten material past these guides around and over the edges of the strip, from which point the metal would, by  
30 capillary action, be carried between the strip and the supporting bottom of the box, and assist also in pressing the strip tightly against the bottom of the box and maintaining it in a flat condition during its passage therethrough. One of the  
35 greatest difficulties in prior apparatus which have been tried in the application of one molten metal to another solid metal has been the overflow of the molten metal over the edge of the solid strip, from which point it would sift in between the  
40 strip and the support and there freeze, blocking the entire apparatus, or, if the strip continued to pass through the apparatus, covering the rear surface from which it had to be subsequently removed by expensive operations.

45 The molten coating is continuously confined to the predetermined portion of the upper surface of the strip by continuation of the guides 16 past the end 11 of the pouring box, these continuing guides being shown at 19 and extending past the  
50 point where the pouring metal is in a truly liquid and fluid condition.

By maintaining a constant head on the babbitt in the pouring box, by the maintenance of a constant speed of movement of the steel strip through the box, and by close control and adjustment of the movable gate 11 at the exit end of the box, we have found it possible to apply a substantially uniform thickness of the bearing metal to the steel strip and to thus maintain a substantial  
60 constant temperature in the strip at any given point beyond the pouring box. These conditions and steps make it possible to practically instantaneously solidify the molten metal at a desired point after its issuance from the pouring box and  
65 in a time interval which is merely a fraction of a second. This solidification we accomplish by flooding the lower side of the strip 2 with a cooling liquid, such as water, at a given point beyond the end of the guides 19, the water being flooded  
70 all over the lower surface of the strip, (see Fig. 6), but being confined as to the point at which it affects the strip by means of guide or baffle 20, which presses against the lower end of the strip, as indicated in Fig. 1, and prevents the passage  
75 of water beyond its point of contact with the

strip. The molten babbitt can in this way be solidified instantly and at a point in the movement of the strip from the pouring box to a pair of pulling rolls 21, which are employed to draw the strip through the entire apparatus.

5 It will be apparent that other forms of guides may be employed for securely contacting the strip along certain areas, blanking off the balance of the strip from contact with the babbitt and confining the babbitt to the portion of the strip be-  
10 tween the guides, and if desired, these guides may contact the strip either at its outer edges, at points closely adjacent to the outer edges as shown, or, in some cases, adjacent to the outer edges and centrally of the strip if it is desired  
15 to have an uncoated ribbon of material intermediate the edges of the entire strip.

In Fig. 6 we have shown a modified form of guide means consisting of a support 30 and triangular guides 31 formed integrally therewith, the  
20 guides being provided with inclined faces 32 which contact snugly against the corners or edges 34 of the reinforcing strip which passes through the guides. These guides act to prevent flow of metal past the edges of the strip and produce a compos-  
25 ite strip consisting of a lower layer of supporting metal and an upper layer extending to the edges of the lower layer, but having beveled sides produced by the inclined faces 32 on the guides.

By our improved method we have found it pos-  
30 sible to continuously coat a commercial strip of steel with a coating which can be accurately adjusted in thickness to the uses to which it is possible to be put, while confining the portion of the steel coating to a predetermined area of  
35 the entire strip and preventing any overflow of molten material which will tend either to coat those parts of the strip which are desired to be left in their original condition or prevent the smooth and continuous passage of the strip  
40 through the apparatus. At the same time the physical structure of the bearing metal can be closely controlled and maintained approximately at the desired condition without undesirable grain growth and without any undesirable crystalline  
45 characteristics.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the means  
50 and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

We therefore particularly point out and distinctly claim as our invention:—

55 1. In a method of applying a coating of bearing metal of substantial thickness to a strip, the steps which consist in continuously moving a backing metal strip, applying molten bearing metal to said backing strip while maintaining  
60 said molten metal under a uniform static head throughout the area of the portion of the strip engaged by said molten metal, and confining contact between such molten bearing metal and said strip to a predetermined portion of the surface  
65 of said strip, whereby overflow of molten metal beyond such predetermined portion of said strip is prevented.

2. In a method of applying a coating of bearing metal of substantial thickness to a strip, the  
70 steps which consist in continuously moving a backing metal strip, applying molten bearing metal to said backing strip while maintaining said molten metal under a uniform static head throughout the area of the portion of the strip  
75



engaged by said molten metal, and confining contact between such molten bearing metal and said strip to a predetermined portion of the surface of said strip, whereby overflow of molten metal beyond such predetermined portion of said strip is prevented, and controlling the thickness of such applied bearing metal layer to predetermined specifications.

10 3. In a method of applying a coating of bearing metal of substantial thickness to a strip, the steps which consist in continuously moving a strip of steel through and under a bath of molten bearing metal while maintaining a constant uniform static head in said bath, preventing contact between the molten bearing metal of said bath and said strip over a certain portion of the area of said strip, continuing to prevent contact between the coating of molten bearing metal carried on said strip upon issuance from said bath and the remainder of the surface of said strip,

and then substantially instantaneously solidifying such molten metal.

4. In a method of applying a coating of bearing metal of substantial thickness to a strip, the steps which consist in continuously moving a strip of steel through and under a bath of molten bearing metal while maintaining a constant uniform static head in said bath, preventing contact between the molten bearing metal of said bath and said strip over a certain portion of the area of said strip, continuing to prevent contact between the coating of molten bearing metal carried on said strip upon issuance from said bath and the remainder of the surface of said strip, and flooding the uncoated surface of said strip with a quantity of liquid material at a temperature sufficient to substantially instantaneously solidify the molten bearing metal on the other surface thereof.

JOHN V. O. PALM. 20  
GEORGE S. SALZMAN.