

April 1, 1958

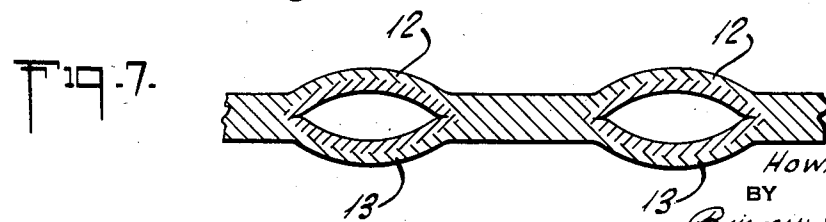
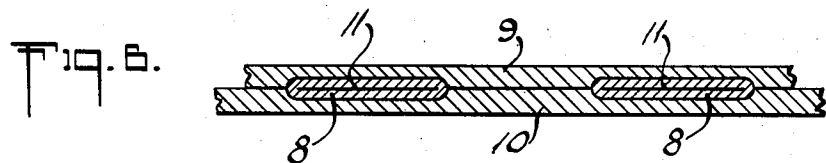
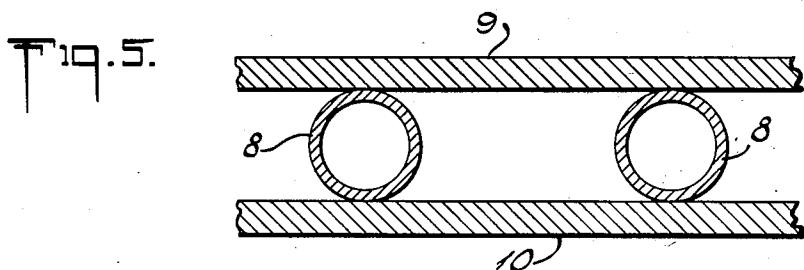
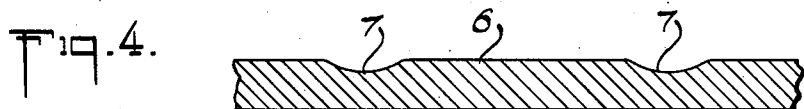
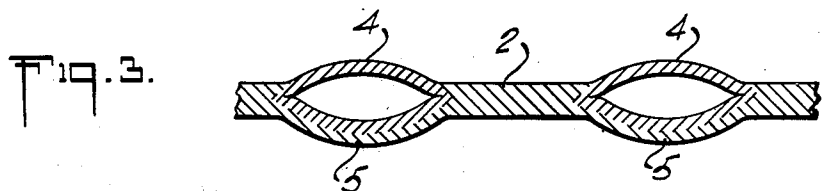
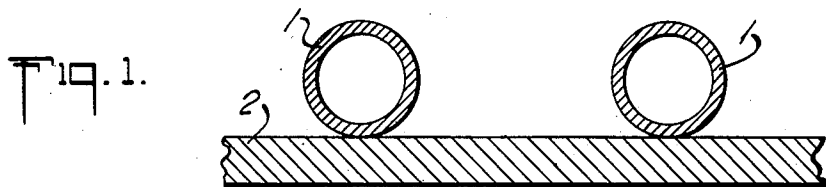
H. A. FROMSON

2,828,533

METHOD OF MAKING INTEGRAL SHEET AND TUBING PRODUCTS

Filed Dec. 19, 1956

2 Sheets-Sheet 1



INVENTOR
HOWARD A. FROMSON
BY
Burgess, Ryan, & Hickey
ATTORNEYS

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H. A. FROMSON

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2 Sheets-Sheet 2

Fig. 8.

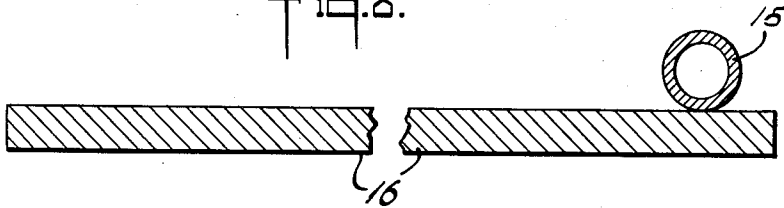


Fig. 9.

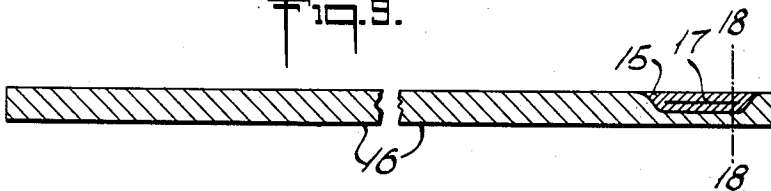


Fig. 10.

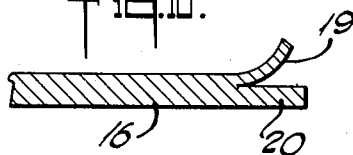


Fig. 11.

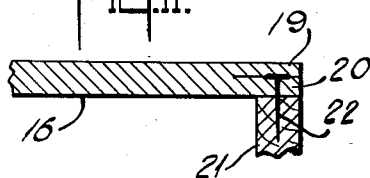
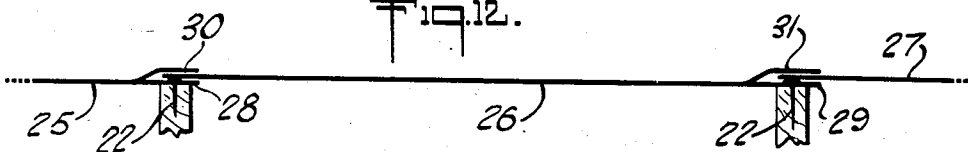


Fig. 12.



INVENTOR
HOWARD A. FROMSON
BY
Burgess, Ryan, & Hicks
ATTORNEY

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2,828,533

METHOD OF MAKING INTEGRAL SHEET AND TUBING PRODUCTS

Howard A. Fromson, Weston, Conn.

Application December 19, 1956, Serial No. 629,330

7 Claims. (Cl. 29—157.3)

This is a continuation-in-part of application Serial No. 621,700 filed November 13, 1956, now abandoned.

This invention relates to the manufacture of sheet metal products and particularly to a method of making an intermediate product adaptable to ready conversion into different end products, including a novel roofing or siding panel and also integral tube and sheet or web products.

As will appear, the invention makes use of the known facts that various metals can be bonded to one another by rolling and that such bonding can be prevented in desired areas or zones as by interposing resist materials where desired.

The invention will be readily understood from the following description and the accompanying drawings. The figures are schematic in the sense that they are not to scale, it being deemed of more importance to illustrate the principles than dimensional details or proportions which, in any event, may be varied widely. In these drawings:

Fig. 1 is a cross section of a portion of a slab and two tubes prior to rolling according to the invention;

Fig. 2 is a similar section of these components after rolling into what is termed herein the intermediate product;

Fig. 3 is a cross section of the rolled product after the tube portions have been expanded for one type of end use;

Fig. 4 is a cross section of a portion of a slab of modified form;

Figs. 5, 6 and 7 are sections corresponding to Figs. 1, 2 and 3 but illustrating the use of two slabs instead of one;

Fig. 8 is a cross section of tube and sheet or slab components for making a modified form of intermediate product;

Fig. 9 is a similar section showing such modified intermediate product;

Fig. 10 is an enlarged section of the bifurcated edge of the same intermediate product; and

Figs. 11 and 12 are sections illustrating uses of the modified form of end product.

According to the present invention use is made of a preformed metal tube. Preliminarily the interior of the tube is treated to prevent bonding of the opposite wall portions of the tube when it is compressed or rolled flat. In the art of rolling, various methods are known for preventing the bonding of metal-to-metal under rolling pressures and any such suitable method may be applied in the treatment of the tube interiors. The treatment can be effected, for example, by filling the tube with friable, graphite base, resist material of the kind sometimes used in the manufacture of so-called "Tube-in-Strip." Other methods of treatment are set out in Patent No. 2,375,334. As will be understood, the word "treatment" is used broadly to encompass any appropriate procedure, whether it involves packing the tube or merely coating or otherwise treating its interior surface.

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One or more treated tubes, as indicated at 1 in Fig. 1, are applied to the surface of a piece of metal in the form of a slab or sheet 2 and then rolled. In order to ensure effective bonding of the components the outer surfaces of the tubes and the face of the metal sheet or slab should be clean and reasonably oxide free. Normally, the rolling is effected lengthwise of the tubes and to effect whatever thickness reduction and coincident elongation is appropriate for the particular end product. Fig. 2 is intended to illustrate the type of section of the intermediate product which results, the tubes being literally rolled into the slab. The lines 3, 3, represent the internal, unbonded surfaces where the original tube walls abut one another. While in this Fig. 2 the outlines of the tubes embedded in the slab are shown distinctly, it will be understood that the tubes actually lost their identity, being so bonded and merged in the rolling as to become, with the slab, an integral product. In order to improve the bond the rolled assembly may be annealed so that recrystallization takes place across the bond interfaces.

This or similar intermediate products resulting from the above method can readily be converted into end products having various uses. For example, a suitable tool may be inserted between the unbonded surfaces designated 3 and these surfaces separated and the "tube" sections expanded or inflated by mechanical, pneumatic or hydraulic means. The resulting product has a section similar to that illustrated in Fig. 3. As will be noted, the upper walls 4, which comprise the original tube walls, are thinner than the lower walls 5, which comprise tube walls plus slab metal. This type of product is suitable for a variety of heat exchanger applications.

In Fig. 4 the slab 6 is shown grooved at 7. Such or other appropriate grooving may be employed to locate the tubes prior to rolling or to reduce the slab thickness where the tubes are to be rolled in. Also, of course, in the method of Fig. 1 the tubes can be suitably secured to the slab to ensure against lateral movement during rolling.

The method of Figs. 5, 6 and 7 differs from the foregoing only in that the tubes 8 are rolled between two slabs 9, 10 rather than with a single slab. The tubes are treated, as before, prior to rolling and, after rolling the product has the general section illustrated in Fig. 6, the reference 11 indicating the unbonded surfaces. When the "tubes" are then inflated, as indicated in Fig. 7 their upper and lower wall thicknesses 12, 13 are, of course, equal (assuming the original upper and lower pieces of metal to be of the same thickness). These upper and lower walls of the expanded tube elements consist, of course, of the walls of the original preformed tubes encased, as it were, in outer walls of slab material. It will be recognized, therefore, that the walls of the original tubes can be made thinner than would be feasible or desirable were they not so encased or reinforced.

As will be apparent, the method of this invention permits the use of preformed tubes of any desired size, thickness and form and what is most important, makes it possible to provide tube sections of one composition (that is, one metal or alloy) and web or sheet portions of a different composition, thus creating an entirely new type of integral sheet and tubing product. For instance, where the corrosion resistance of the tube is required to be such as to call for the use of a relatively expensive metal or alloy, the piece which is to form the web or sheet portion can be of a less expensive metal or alloy. When two such compositions are employed the product of Fig. 3 will have one wall of the tube portion of one composition only (that is, the upper or thinner wall as shown) and the other or thicker wall will be composed of an inner "layer" of the said one composition and an outer "layer" of a different composition, namely, of the web material; whereas in the Fig. 7 type of product, the

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web portions and outer "layers" of the tube walls will be of one composition and the inner "layers" of the tube walls will be of a different composition. The respective "layers" are indicated by the different cross-hatchings in Figs. 3 and 7.

The above described method of making the intermediate product is useful also in the manufacture of a novel end product in the form of a metal panel for roofing or siding or the like.

In Fig. 8 a single tube 15 is shown placed adjacent the edge of a relatively wide metal piece 16. The tube is treated, as before, so that after rolling the intermediate product of Fig. 9 is formed. As in the Fig. 2 form, internal, unbonded surfaces occur (as at 17) where the original tube walls abut one another.

Various end products can be formed from this intermediate product by cutting or slitting the rolled sheet at least to the depth of the unbonded surfaces to form a bendable flap which can be used as an anchorage for the sheet. In the illustrated exemplification the line 18 indicates a cut made clear through the sheet at such a distance from its edge as to intersect both of the unbonded surfaces 17. The result, as will be recognized, is to create a bifurcated sheet edge. For use as roofing or siding panels the sheets might be of a thickness of the order of .030 inch and hence too thin to slit but by the indicated method two edge flaps 19, 20 are readily formed, their combined thickness equalling that of the body of the sheet or panel. Furthermore, as in the making of the inflated tube type of product, the original tube may be of a different composition from that of the sheet itself so as, for example, to provide edge flaps of higher tensile strength.

In use, the bifurcated edge panel can be secured by nailing or otherwise securing flap 20, as to a stud 21 (Fig. 11) and the perforation and nail 22 covered by the other flap to provide an unbroken outer surface.

Fig. 12 illustrates another application of a series of such panels 25, 26, 27 in which the lower flaps 28, 29 are secured as above indicated and the upper flaps 30, 31, with the lower, form sockets to receive the other edges of the panels. The upper flaps can be snugged down on top of the enclosed panel edges without destroying what is, in effect, an expansion joint.

As will be apparent, the invention is applicable to all metals and alloys which are susceptible to bonding when rolled.

In the light of the foregoing exemplifications of the principles of the invention the following is claimed:

1. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is compressed, applying the so-treated tube to the face of a piece of metal and rolling the tube and metal piece to flatten the tube and coincidentally to bond the two together to form an integral, sheet product having internal, unbonded surfaces where the original tube walls abut one another.

2. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is compressed, applying the so-treated tube to the face of a piece of metal, rolling the tube and metal piece to flatten the tube

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and coincidentally to bond the two together to form an integral sheet product and thereafter expanding the flattened tube portion of the product.

3. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is rolled flat, grooving the face of a slab of metal, seating the treated tube in the slab grooving, rolling the tube and slab to sheet form and coincidentally bonding the two together to form an integral sheet product and thereafter expanding the flattened tube portion of the product.

4. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is compressed, applying the so-treated tube to the face of a piece of metal of a different composition and rolling the tube and metal piece to flatten the tube and coincidentally to bond the two together to form an integral sheet product having internal, unbonded surfaces where the original tube walls abut one another.

5. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is compressed, applying the so-treated tube to the face of a piece of metal, superimposing on the tube a second piece of metal, rolling the tube and metal pieces to flatten the tube and coincidentally to bond the three together to form an integral, sheet product.

6. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is compressed, applying the so-treated tube to the face of a sheet of metal, rolling the tube and sheet to flatten the tube and coincidentally to bond the two together to form an integral sheet having internal, unbonded surfaces where the original tube walls abut one another and cutting the sheet, longitudinally of the original tube disposition, to form a flap portion out of the part of the sheet having one of said unbonded surfaces.

7. The method which includes the steps of treating the interior of a preformed metal tube to prevent bonding of the opposite wall portions when the tube is compressed, applying the so-treated tube to the face of a sheet of metal, rolling the tube and sheet to flatten the tube and coincidentally to bond the two together to form an integral sheet having internal, unbonded surfaces where the original tube walls abut one another and cutting off a marginal portion of the integral sheet to a distance from the said edge such as to intersect said unbonded surfaces and thereby create a bifurcated sheet edge.

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