Dec. 3, 1968 R. W. MINOGUE 3,414,305

PLASTIC-METAL JOINT AND METHOD FOR PRODUCING THE SAME

Filed July 7, 1966

FIG. 1

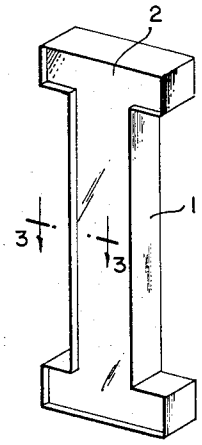


FIG. 2

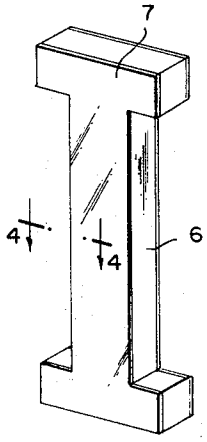


FIG. 3

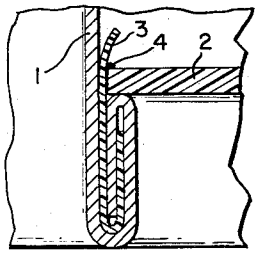
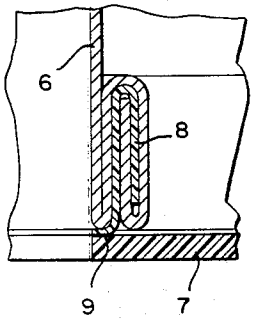


FIG. 4



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PLASTIC-METAL JOINT AND METHOD FOR PRODUCING THE SAME

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ABSTRACT OF THE DISCLOSURE

A joint-structure and method of forming the same wherein a panel of rigid material is secured to malleable sheet material by folding a strip of flexible sheet material into the edge of the malleable sheet material and bonding the rigid sheet to the flexible strip.

The present invention relates to a joint structure between rigid plastic sheet material and malleable sheet metal material and to the method for making the same.

In such industries as sign making and display apparatus as well as enumerable other industries including the automobile industry, it has become quite desirable to combine structural materials such as thin malleable sheet metal and rigid plastic sheet material to obtain such effects as pleasing appearance, transparency or opaqueness, electrical nonconductivity and many others. A problem is presented, however, when attempting to join a rigid sheet of plastic or other rigid material to a sheet metal frame or the like. Common methods for accomplishing such joints have involved screws or other types of fasteners, glue, specially formed sheet metal retaining channels or clips and so on. The difficulties with such prior art methods have been the lack of durability and strength, the relatively costly hand work involved and the inability to attain a pleasing appearance.

According to the present invention, a joint structure and method for producing the same are provided to overcome the deficiencies of the prior art by incorporating a flexible plastic strip into a metal fold thus providing a compatable plastic surface to which the rigid plastic sheet material may be permanently and securely bonded.

Accordingly, the object of the present invention is to provide an improved joint structure between malleable sheet material such as sheet metal and rigid sheet material such as hard plastic, which is both strong and durable and pleasing in appearance.

A further object of the present invention is to provide a method of forming a joint of the character described which enables the joint to be constructed in an economical manner and which results in a durable joint which is pleasing in appearance.

Still further objects and advantages of the present invention will appear and be understood from the following description of the preferred embodiments and from the accompanying drawing, in which:

FIG. 1 illustrates a display structure resulting from one embodiment of the present invention;

FIG. 2 illustrates a display structure resulting from a second embodiment of the invention;

FIG. 3 is a cross sectional detail taken along lines 3—3 of FIG. 1 and showing the formation of one type of plastic-metal joint; and

FIG. 4 is a cross sectional detail taken along lines 4—4 of FIG. 2 showing another type of plastic-metal joint.

Referring now to the drawings wherein like reference numerals indicate identical parts in the various views, FIGS. 1 and 2 illustrate the application of the present invention to the formation of display signs by way of illustration only and it will be understood that the present

structure and method may be utilized in the formation of a plastic-metal joint for any use desired.

Referring to FIG. 1, a letter "I" is formed which may be used as a letter in a sign display or the like. In this embodiment, a peripheral sheet metal frame **1** is joined to a rigid plastic sheet material **2** which is recessed from the edge of the sheet metal frame to give a desired appearance. The sheet metal **1** may comprise any type of ferrous or nonferrous sheet metal with or without finish such as paint, plastic vinyl, annodized surface and the like commonly used in the prior art. The rigid plastic sheet material may comprise any rigid plastic material known to the prior art such as but not limited to vinyl resins, celluloses, glass fiber laminates and the like.

Referring to FIG. 3, the plastic-metal joint is accomplished by forming at least one or more turns in the edge of the sheet metal **1** to form a tubular convolute with a thin flexible plastic sheet **3** nested or folded into the tubular metal convolute. The type of fold illustrated is commonly used in the sheet metal art and is known as the Pittsburgh lock. The metal **1** in FIG. 3 has been folded into a double folded convolute at right angles to the surface of the rigid plastic sheet **2**. The relatively thin flexible plastic sheet may constitute sheet material in the cellulose acetate group, for example, or any other flexible plastic sheet material having the necessary strength characteristic and the ability to be bonded to the rigid plastic sheet **2** and in some cases the surface of the metal **1**.

To achieve the recessed appearance of the rigid plastic sheet **2**, the flexible plastic strip **3** extends upwardly and may be bonded to the edge portion of the rigid plastic sheet as at **4** by any cement which is compatible to both materials such as a solvent or any contact cement or epoxy cement found in the prior art. Because of the extremely strong and permanent bond which may be obtained between the relatively thin plastic sheet **3** and the rigid plastic sheet **2**, and because of the mechanical connection between the flexible sheet **3** and the folded sheet metal **1**, the plastic-metal joint is extremely strong and durable. The flexible plastic sheet **3**, if desired, may also be bonded by suitable cement to the sheet metal **1** in the area of the folds. In any event, the convolute or fold of the sheet metal **1** are flattened down or pressed causing the metal to mechanically clinch or grip the flexible plastic strip to prevent removal of the plastic sheet from the metal fold.

FIG. 2 illustrates a second embodiment of the present invention wherein a sheet metal frame **6** is used to mount a rigid plastic facing sheet **7** on its peripheral edge and, in this case, with the edge of the plastic sheet flush with the outside surface of the metal frame **6**. It is of course possible to mount a rigid plastic sheet on both edges or faces of the metal frame as illustrated. In this embodiment, it will be understood that the type of materials may be identical to that described in the embodiment in FIGS. 1 and 3. FIG. 4 illustrates the details of the plastic-metal joint for the second embodiment. In this case, a double convolute is formed in the sheet metal **6** and the convolutions are then reversely folded as illustrated with the relatively thin flexible plastic sheet **8**, which may be identical with the plastic sheet **3** of the first embodiment, folded into the convolutions of the sheet metal. As previously mentioned, it will also be desirable in some cases to bond the flexible plastic strip **8** to the surface of the sheet metal forming the convolutions. The folded portions of the sheet metal are then pressed or flattened to insure a strong grip on the flexible plastic strip **8**. The facing sheets **7** of the rigid plastic are then fastened to the sheet metal frame by bonding the inside peripheral portion of the sheet to the protruding edge of the strip **8** as shown at **9** in FIG. 4, with a cement compatible to both

the flexible and rigid plastic materials. The excess strip material is then trimmed away.

The plastic-metal joint of the present invention is accomplished by first folding the thin flexible plastic sheet into the edge of the sheet metal strip thus making the plastic secure in the fold and leaving an exposed flexible plastic strip to which the rigid sheet can be joined. If additional bonding is desired between the sheet metal and the flexible plastic strip, a suitable cement may be applied before the folding. The securing of the flexible plastic strip to the sheet metal should be done with at least one turn and preferably multiple turns of the metal which forms the tubular convolute as shown in the drawings. The folding of the metal and plastic strip is accomplished by sheet metal bending equipment known to the art requiring little or no hand work.

After the flexible plastic strip is thus folded into the edge of the sheet metal, the convolutions are then flattened or pressed down causing the metal to clinch the plastic so that the plastic strip may not be pulled out of the convolution.

The rigid plastic sheet is then bonded directly to the exposed edge of the flexible plastic strip as described. With relation to the embodiment shown in FIGS. 1 and 3, the rigid plastic sheet is laid on top of the convolute formed by the folds of the sheet metal and nested against the thin flexible plastic sheet. The bonding agent may then be applied between the flexible sheet and the rigid sheet as shown in FIG. 3. With relation to FIGS. 2 and 4, the sheet metal **6** with the reverse double fold is placed at right angles to the rigid plastic sheet **7** with the protruding portion of the thin plastic strip **8** between the metal and the rigid plastic sheet. The bonding agent may be applied to the flexible strip or to the rigid sheet before it is placed against the sheet metal frame. The rigid plastic sheet **7** can be preformed to the desired shape and the excess flexible plastic strip trimmed off after the bond has been completed.

It will be readily apparent to those skilled in the art that the present invention provides novel and useful improvements in plastic-metal joints and methods of forming the same. The arrangement and types of structural components utilized within this invention and the method steps involved may be subjected to numerous modifications well within the purview of this invention and applicant intends only to be limited to a liberal interpretation of the specification and appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A sheet metal-to-plastic joint between a thin metal sheet and a rigid plastic sheet comprising; a flexible plastic strip, a tubular convolute formed on the edge of said metal sheet, one edge of said flexible plastic strip being tightly nested within the tubular convolute, said rigid plastic sheet being located in close proximity to said convolute, the other edge of said flexible plastic strip being exposed, and bonding means securing the exposed edge of the flexible plastic strip to the surface of said rigid plastic sheet, whereby said rigid plastic sheet is held securely against the metal sheet.

2. The joint structure according to claim **1** wherein, the exposed edge portion of said flexible strip extends along the surface of the metal sheet and in a direction away from the folded edge thereof, said rigid plastic sheet resting on said convolute recessed inwardly from the folded edge of the sheet metal with the peripheral edge of the rigid plastic sheet being bonded to the exposed edge of the flexible plastic sheet.

3. The joint structure according to claim **1** wherein; the exposed edge portion of said flexible strip extends outwardly from said tubular convolute in a direction away from the folded edge of said metal sheet, said rigid plastic sheet overlying the folded edge of the metal sheet with the exposed edge portion of the flexible strip located between the rigid sheet and the folded edge of the metal sheet and bonded to the rigid sheet.

4. A method of securing a panel of rigid sheet material to a panel of malleable sheet material comprising; folding a strip of flexible sheet material into the edge of said malleable sheet with one edge portion of the flexible sheet being exposed, applying pressure to the folds of said flexible sheet and said malleable sheet to mechanically lock the flexible sheet therein, and then bonding the rigid sheet to the flexible sheet with the rigid sheet resting against the folds of the malleable sheet.

5. The method according to claim **4** wherein; said flexible strip and said malleable sheet are folded into a single convolute and said rigid sheet is placed against the convolute recessed from the folded edge of the malleable sheet and then bonded to the exposed edge of the flexible strip.

6. The method according to claim **4** wherein; said flexible strip and said malleable sheet are folded into a double convolute and said rigid sheet is located adjacent the folded edge of the malleable sheet, said rigid sheet being then bonded to the exposed edge of the flexible strip located between the folded edge of the malleable sheet and the surface of the rigid sheet.

References Cited

UNITED STATES PATENTS

3,302,825 2/1967 Schleeweiss ---------- 220—67

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