United States Patent [19]

Pryor et al.

[11] **3,867,799**

[45] **Feb. 25, 1975**

[54] **ARCHITECTURAL PRODUCTS FORMED OF GLASS OR CERAMIC-TO-METAL COMPOSITES**

[75] Inventors: **Michael J. Pryor,** Woodbridge; **James M. Popplewell,** Guilford, both of Conn.

[73] Assignee: **Olin Corporation,** New Haven, Conn.

[22] Filed: **Feb. 11, 1974**

[21] Appl. No.: **440,982**

Related U.S. Application Data

[60] Division of Ser. No. 254,666, May 18, 1972, , which is a continuation-in-part of Ser. Nos. 78,899, Oct. 7, 1970, Pat. No. 3,676,292, and Ser. No. 231,834, March 6, 1972, Pat. No. 3,826,627.

[52] **U.S. Cl.** **52/235**

[51] **Int. Cl.** **E04b 2/88**

[58] **Field of Search** 52/235, 573; 72/162; 161/196; 29/472.3

[56] **References Cited**

UNITED STATES PATENTS

3,220,815	11/1965	McMillan	161/196
3,381,364	5/1968	Winter	29/472.3

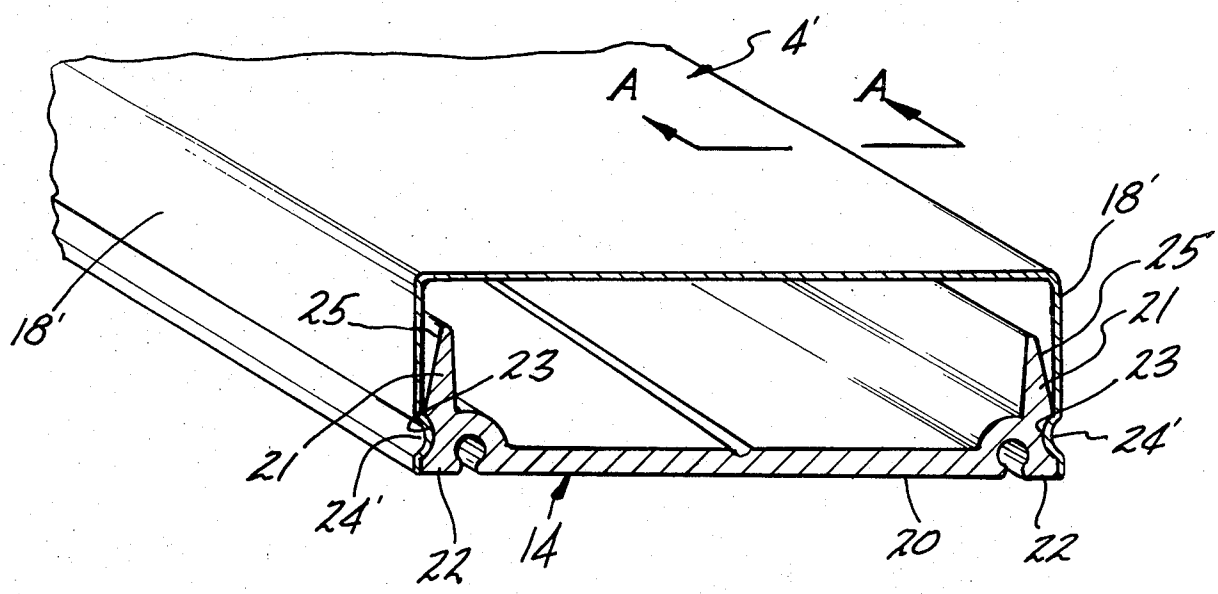
Primary Examiner—John E. Murtagh

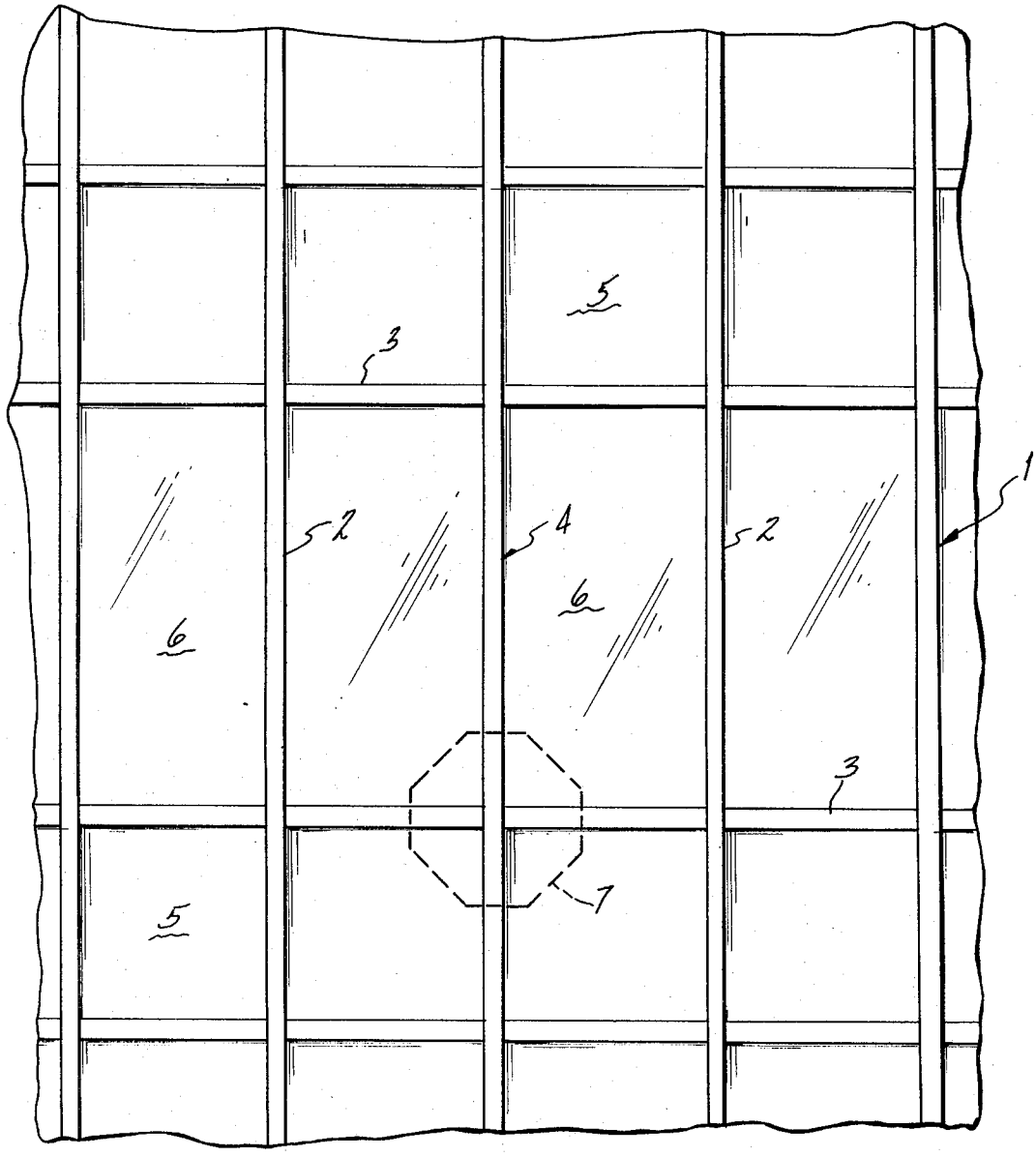
Attorney, Agent, or Firm—David A. Jackson; Robert H. Bachman

[57] **ABSTRACT**

Architectural products comprising a glass or ceramic-to-metal composite sheet which comprises at least one glass or ceramic component bonded to a copper base alloy component containing from about 2 to about 12% aluminum. The composite sheet may be employed as a panel supported or unsupported by a backing member. The composite sheet may also be employed in building curtain wall.

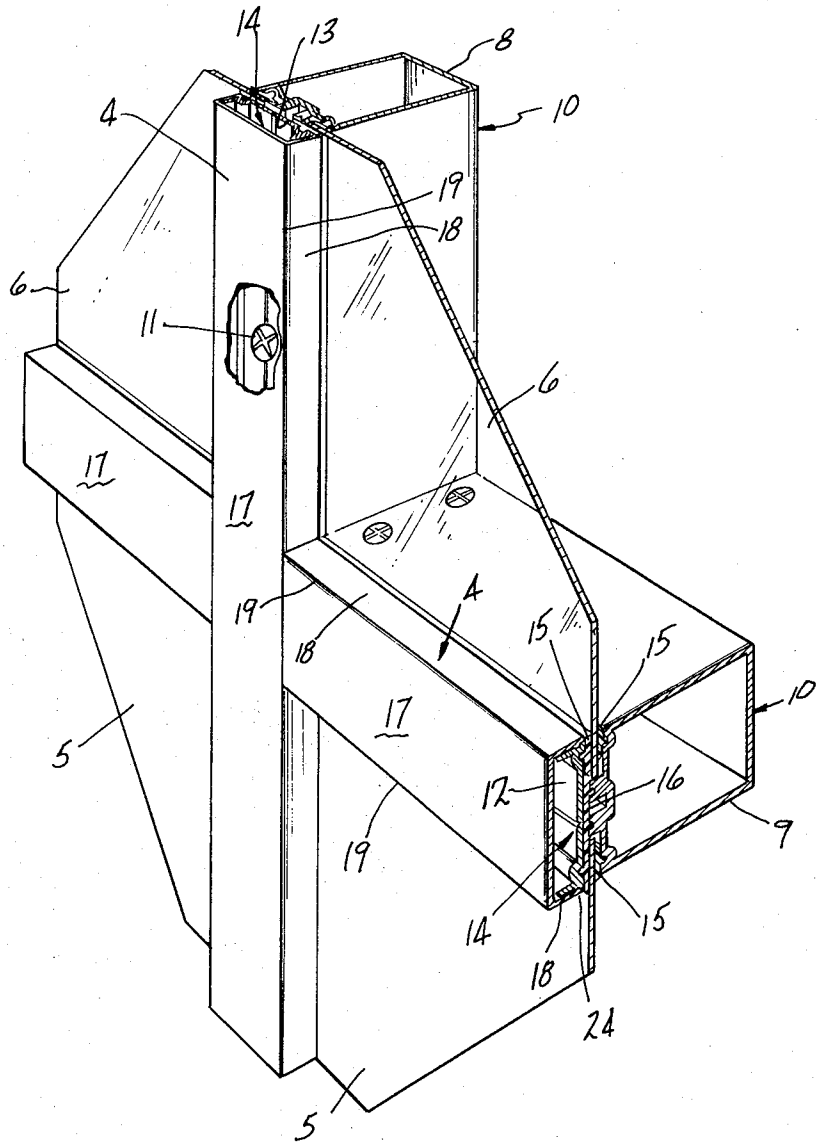
16 Claims, 8 Drawing Figures





PRIOR ART

FIG-1



PRIOR ART

FIG-2

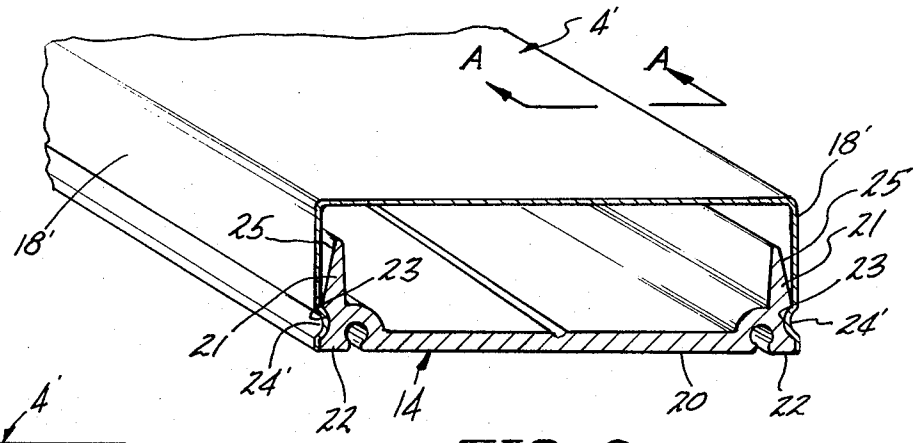


FIG-3

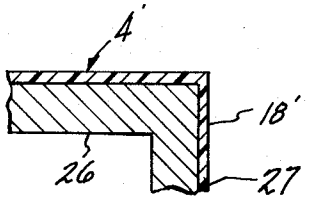


FIG-4

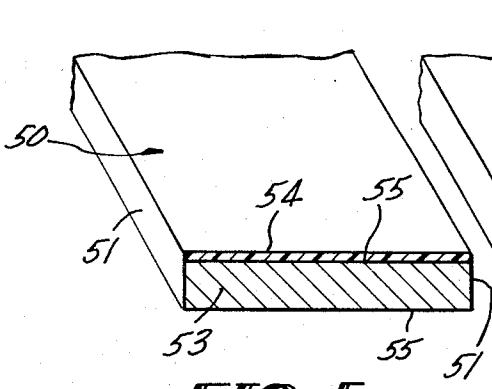


FIG-5A

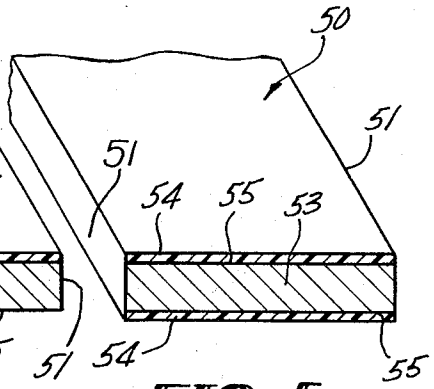


FIG-5B

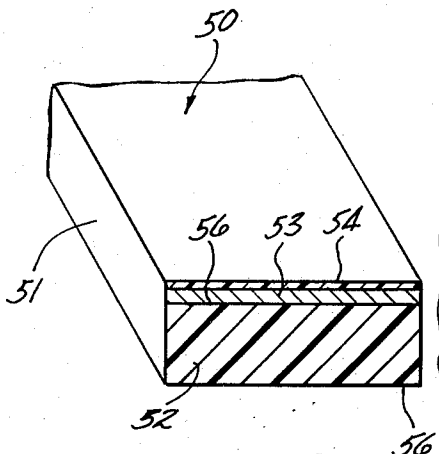


FIG-5C

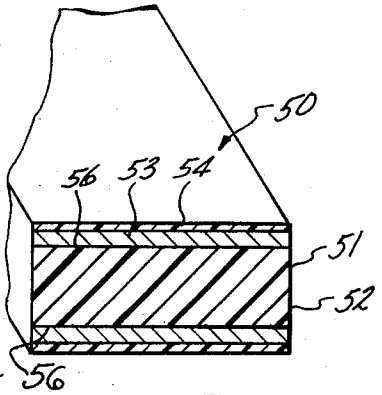


FIG-5D

ARCHITECTURAL PRODUCTS FORMED OF GLASS OR CERAMIC-TO-METAL COMPOSITES

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a division of application Ser. No. 254,666, filed May 18, 1972 which is in turn a continuation-in-part of application Ser. No. 78,899, filed Oct. 7, 1970 now U.S. Pat. No. 3,676,292 and Ser. No. 231,834, filed Mar. 6, 1972, now U.S. Pat. No. 3,826,627.

BACKGROUND OF THE INVENTION

In the architectural field, it is known to employ copper alloys in applications such as building curtain wall. In accordance with this invention, it has been found that a novel glass or ceramic-to-metal composite wherein the metal is a copper base alloy having at least about 2 to 12% aluminum is uniquely adaptable to architectural uses such as building curtain wall, internal wall constructions, partitions and other types of panels and architectural facings where a decorative and pleasing appearance is desired.

It is well known that copper base alloys rapidly tarnish in most atmospheres to produce oxides and compounds of copper which detract from the aesthetical appearance thereof and therefore require mechanical or chemical cleaning to restore their pleasing appearance. Various coatings of paints or lacquers have been applied to the surfaces of these alloys in order to provide tarnish and oxidation resistance; however, these paints and lacquers generally are not very durable. This lack of durability often results in exposing various areas of the underlying metal surface which in turn leads to selective corrosion attack of the metal at the exposed areas.

In U.S. application Ser. No. 78,899, there is disclosed a glass or ceramic-to-metal composite comprising a glass or ceramic component bonded to a copper base alloy component comprising 2 to 12% aluminum and the balance essentially copper. In accordance with this invention the glass or ceramic component provides a very durable and corrosion resistant surface and, therefore, this composite is uniquely suited for use in architectural applications, such as those enumerated above.

SUMMARY OF THE INVENTION

In accordance with this invention, the glass or ceramic-to-metal composite disclosed in U.S. application Ser. No. 78,899 is employed as a facing for architectural applications, such as building curtain wall, internal wall constructions, partitions, and other types of panels and architectural facings. For some applications, the composite may be used without any backing; however, for other applications, the composite may be affixed to a suitable backing member to provide additional support.

The backing member may comprise any conventional type of backing material such as, for example, metal, plastic, wood, polymeric foam, such as a rigid polyurethane foam, gypsum wall board, plywood, particle board, hard board or other suitable materials useful for this purpose. The composite can be affixed to the backing member by any conventional means such as the use of glue or other types of adhesives.

This invention is particularly applicable to building curtain wall such as disclosed in U.S. Pat. Nos. 3,466,826, granted Sept. 6, 1969; 3,488,906, granted Jan. 13, 1971; and 3,553,918, granted Jan. 12, 1971. All of these curtain walls have in common the use of a plurality of horizontal and vertical structural members forming a framework for receipt of glazing or decorative panels and a plurality of retaining members for securing the glazing or panels to the framework and a plurality of channel shaped snap on cover or facing members supported by the retaining members for providing an aesthetically pleasing appearance.

In addition the curtain walls of the aforenoted patents include a thermal break feature which insulates the inside framework from the retaining members and cover members on the outside of the building. While this is a highly desirable feature of a building curtain wall, it does not comprise an essential aspect of the instant invention.

This invention is particularly directed with respect to building curtain wall to the use of the aforenoted glass or ceramic-to-metal composite as cover or facing members and as decorative panels either unsupported or supported by a backing member.

The glass or ceramic-to-metal composite in accordance with this invention is unique in that it has been found that the copper base alloy component within certain ranges of composition forms on its surface an oxide layer, one compound of which is Al_2O_3 in the form of a compact continuous film. The Al_2O_3 film forms immediately adjacent to the metal surface and is strongly adherent to it. The Al_2O_3 film comprises at least 10% of the total oxide film thickness. When the glass or ceramic component is bonded to the copper base alloy component having the Al_2O_3 film, a strong bond results.

This high bond strength between the copper base alloy component and the glass or ceramic component allows composites to be fabricated which can tolerate a high degree of mismatch of coefficient of expansion between the glass or ceramic component and the copper base alloy component. Further, where this degree of mismatch can be minimized, a glass or ceramic-to-metal composite is formed having unusually good adherence of the glass or ceramic to the metal due to the high bond strength between the components of the composite.

Therefore, in accordance with this invention, a coated copper base alloy architectural facing is provided having improved durability and corrosion resistance.

It is a further object of this invention to provide a building curtain wall having cover members and/or decorative panels employing a glass or ceramic-to-metal composite wherein the metal is a copper base alloy which forms an Al_2O_3 film on its surface.

It is a further object of this invention to provide panels which can be used in building curtain wall as well as internal wall constructions, partitions, and the like, wherein the panels comprise a glass or ceramic-to-metal composite wherein the metal is a copper base alloy which forms a thin film of Al_2O_3 on its surface, the composite being either unsupported or supported by a backing member.

Other objects and advantages will become apparent to those skilled in the art as a detailed description proceeds with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial front view of a typical prior art building curtain wall.

FIG. 2 is a perspective view of an octagonal section of the curtain wall of FIG. 1.

FIG. 3 is a perspective view showing a cover member in accordance with this invention affixed to a typical prior art retaining member.

FIG. 4 is a cross section along the line A—A of FIG. 3 of a corner portion of the cover member of FIG. 3.

FIG. 5 shows in perspective cross sections of portions of typical panels in accordance with this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

This invention is directed to an architectural facing formed from a glass or ceramic-to-metal composite wherein the metal is a copper base alloy having from about 2 to 12% aluminum and the balance essentially copper. The composite facing of this invention provides an aesthetically pleasing appearance and improved durability and resistance to corrosion and is, therefore, uniquely adapted for use in such applications as building curtain wall, internal wall constructions, partitions and other types of panels.

Suitable copper base alloys for use in the glass or ceramic-to-metal composite facing of this invention preferably contain from about 2% to about 10% aluminum, from about 0.001 to about 3% silicon and a grain refining element selected from the group consisting of iron up to about 4.5%, chromium up to about 1%, zirconium up to about 0.5%, cobalt up to about 1% and mixtures of these grain refining elements. The alloy may also include up to 35% zinc.

In particular, CDA Alloy 638 containing 2.5 to 3.1% aluminum, 1.5 to 2.1% silicon and 0.25 to 0.55% cobalt is most useful.

Impurities may be present in amounts not adversely affecting the properties of the glass or ceramic-to-metal composite facing of this invention. In particular, the impurities may include less than 1% nickel, less than 1% manganese, less than 1% tin, less than 0.5% lead, less than 0.1% phosphorus and less than 0.1% arsenic.

The aforenoted limitations of impurity elements apply to those elements only when they are present as impurities and not if they are used as alloying elements.

The aforenoted copper base alloys form on their exposed surfaces an oxide, one component of which is Al_2O_3 in the form of a thin compact continuous film. The Al_2O_3 film forms immediately adjacent to the metal, is strongly adherent to it and comprises at least about 10% and up to about 100% of the total thickness of the oxide.

Alumina seals efficiently to most glasses and ceramics. Therefore, since the alumina film formed on the alloys used with this invention is tightly adherent to the alloys, an excellent glass or ceramic-to-metal bond is produced.

The alumina film on the alloys in accordance with this invention may be formed by any conventional techniques as are known in the art. It may be formed during the coating of the alloy component with the glass or ceramic component or the alloy component may be preoxidized by conventional techniques such as heating the alloy component to a temperature in the range of 200° to 700°C for a period of time of at least 2 seconds. Normally, however, the alumina film is formed on the surface of the alloy component during the coating of the metal with the glass or ceramic.

Any well known glass or ceramic which will readily fuse with the alumina film on the metal surface may be used as the glass or ceramic in the composite facing of this invention. However, the mismatch in coefficient of thermal expansion between the metal component and the glass component should be less than 110×10^{-7} in./in./°C, and preferably, less than 75×10^{-7} in./in./°C and, more preferably, less than 60×10^{-7} in,/in./°C.

It is one of the unique aspects of the glass or ceramic-to-metal composite facing of this invention that it is

TABLE I

GLASS OR CERAMIC TYPE	COEFFICIENT OF THERMAL EXPANSION in./in./°C
MOST PREFERRED	
* CORNING - Code No. 7047 (Barium Silicate Glass)	140×10^{-7}
* FERRO CORPORATION No. EN-701-A (Clear Porcelain)	approximately 160×10^{-7}
PREFERRED	
* OWENS - Illinois No. 00583 (Sealing Glass)	117×10^{-7}
** BOROSILICATE CLEAR PORCELAIN 50% SiO_2, 20% B_2O_3, 12.5% Cryolite, 10% BaO, 2.5% ZnO, 2.5% K_2O, 2.5% Na_2O	approximately 72×10^{-7}
LEAST PRERERRED	
* G.E. – ReX (Sealing Glass)	90×10^{-7}
** SODA - LIME - SILICA GLASS 70% SiO_2, 11% CaO, 14% Na_2O, + Al_2O_3 + MgO	90×10^{-7}
** PORCELAIN 40% Leucite (K_2O, Al_2O_3, $4SiO_4$) 30% Mullite ($3Al_2O_3$, $2SiO_2$) 30% SiO_2	60×10^{-7}
** SEALING GLASS TYPE 101 ASTM No. F-79-67T 56% SiO_2, 1.5% Al_2O_3, 4.0% K_2O, 29.0% PbO	92×10^{-7}

* Proprietary Composition
** Values in Weight Percent

able to tolerate a substantial mismatch in coefficient of expansion between the glass or ceramic and the metal component. If stronger and/or more elastic glasses are developed even greater degrees of mismatch than above noted could be tolerated.

TABLE I lists various exemplary glasses and ceramics which are adapted for use in accordance with this invention.

The proprietary glass Code No. 7047 manufactured by the Corning Glass company, Corning, N.Y. has a coefficient of thermal expansion which is close to that of Alloy 638 and, therefore, in accordance with the most preferred embodiment of this invention, it is desirable to employ this particular type of glass.

It has also been found that additions of 2 parts boric acid, 1.35 parts KOH, 9.3 parts potassium silicate, 0.5 parts silicic acid per 100 parts of the clear porcelain No. EN-701-A manufactured by the Ferro Corporation, Cleveland, Ohio is beneficial in accordance with this invention.

It has been found that various glasses and ceramics can be employed in this invention and the examples set forth in Table I are not meant to be limitive of the invention.

Preferably, the glass or ceramic component should be clear and transparent so that the full aesthetic appearance of the underlying copper base alloy component shows through; however, the invention is not limited thereto. For example, additions of various compounds to glasses or ceramics are known to cause them to be tinted or colored and, therefore, it is possible to change the color exhibited by the facing of this invention by the addition of such compounds to the glass or ceramic component.

These compounds may include but are not limited to MnO_2, Fe_2O_3, Cu_2O, Co_2O_3, NiO, $K_2Cr_2O_7$, Na_2UO_4, and combinations of these compounds in amounts from 0.1% to about 10% by weight. The use of such additions provides colored facings which vary in color depending on the glass or ceramic which is employed and the particular compounds added thereto. It is possible to obtain bronzes, greens, lavenders, blues, etc., and in particular, the addition of MnO_2 to the Borosilicate Clear Porcelain of Table I yielded a purple tint.

Further, translucent or opague coatings having various colors could also be employed as the glass or ceramic component in accordance with the invention.

Referring to FIGS. **1** and **2**, there is shown an exemplary curtain wall **1** structure as typical of the prior art. Only a portion of the curtain wall **1** is shown. The curtain wall **1** shown in FIG. **1** is typical of designs commonly found in many of todays modern high rise buildings. It comprises a plurality of vertical **2** and horizontal **3** facing members **4** which are part of a framework for holding in place a plurality of decorative panels **5** and windows **6.**

An octagonal section **7** of the curtain wall **1** of FIG. **1** is shown in perspective in FIG. **2.** The curtain wall **1** design shown in FIG. **2** corresponds substantially to the Lupton Series 2500 wall manufactured by the Lupton Manufacturing Company, Philadelphia, Pennsylvania.

This particular curtain wall is described merely by way of example and is not meant to be limitive of the invention. As aforenoted, the curtain wall systems of U.S. Pat. Nos. 3,466,826, 3,488,906 and 3,553,918 are also adaptable for use in accordance with the instant invention as well as a wide variety of other known curtain wall systems which employ facing members **4** and/or decorative panels **5.**

FIG. **2** shows the vertical **8** and horizontal **9** structural members **10** which are secured to the building. Secured to each of the structural members **10** by means of screws **11** are a plurality of corresponding horizontally **12** and vertically **13** disposed retaining members **14.**

The gaps between the retaining members **14** and the structural members **10** are adapted to receive in sealing engagement the decorative panels **5** or windows **6.** The sealing engagement is provided by resilient gaskets **15** which are secured to the structural members **10** and retaining members **14** and which engage the panel **5** or windows **6.** In the curtain wall **1** shown, a resilient gasket **16** is also interposed between structural members **10** and the retaining members **14** to provide a thermal break, except at the points where the screws **11** secure the retaining members **14** to the structural members **10.**

Since the retaining members **14** do not present a pleasing appearance from the architectural point of view, snap on facing members **4** are employed. These facing members **4** provide a pleasing architectural appearance by eliminating from sight the joining screws **11.** The facing members **4** are generally of channel configuration comprising a web section **17** and side walls **18** projecting outwardly in the same direction from the longitudinal edges **19** of the web section **17.**

The retaining members **14** are also of a channel configuration as best shown in FIG. **3** comprising a web section **20** and side walls **21** projecting outwardly in the same direction and extending from the longitudinal edges **22** of the web section **20.** Each side wall **21** includes an outside groove **23** adapted to receive a corresponding rib **24** from the snap on facing member **4** and an inclined outer portion **25** for making it easier to snap the facing member **4** onto the retaining member **14** by providing a wedge type action to spread apart the side walls **21** of the facing member **4** until it is snapped in place with the ribs **24** of the facing member seated in the grooves **23** of the retaining member **14.**

FIG. **3** shows a typical facing member **4'** in accordance with this invention in place after it has been snapped onto a conventional retaining member **14.** The facing member **4'** has a similar channel configuration to that of the facing member **4** of the prior art except that the ribs **24** which are adapted to seat in the grooves **23** of the retaining member **14** comprise grooves **24'** in the side walls **18'** of the facing member **4'.**

The grooves **24'** formed in the side walls **18'** of the facing member **4'** of this invention may have any desired shape which is adapted to seat in the grooves **23** of the retaining member **14.** The grooves shown in FIG. **3** have a semi-circular shape; however, any desired shape could be employed.

The cross section taken along the line A—A of FIG. **3** and shown in FIG. **4** clearly shows the composite of this invention having the copper base alloy component **26** and the glass or ceramic component **27** bonded thereto. While copper base alloys are by their nature

more expensive than aluminum, there is a considerable savings in materials involved in accordance with this invention because thin sheet may be used for the facing member 4' thereby using less metal. For example, it has been found that the facing members 4' formed from composite sheet wherein the metal is from 0.01 inch to 0.06 inch thick have sufficient strength to replace the conventional extruded aluminum facing members 4 which are considerably thicker.

In accordance with this invention, the aforenoted glass or ceramic-to-metal composite facing is also useful as panels for architectural and decorative purposes. The panels **50** comprise a sheet like structure, portions of which are shown in FIG. **5**. The peripheral edge **51** of the panel **50** may have any desired shape as, for example, it may be rectangular, square, circular, etc., or any other conventional shape employed for architectural or decorative purposes. FIG. **5** shows sections in perspective or rectangular type panels **50**.

The composite facing may be used as a panel **50** either supported or unsupported by a backing member **52**. An unsupported panel **50** as shown in FIG. 5A would comprise merely a sheet of the glass or ceramic-to-metal composite having the desired peripheral edge **51** shape. An unsupported panel **50** would generally require the use of a thicker metal component **53** in the composite to provide sufficient resistance to flexure which might cause damage to the glass or ceramic component **54** such as cracking.

The panel **51** may have a glass or ceramic component **54** on one major face **55** as in FIG. 5A or on both major faces **55** as in FIG. 5B the latter configuration being most useful in wall constructions, partitions and the like where both sides of the panel are visible.

It is economically advantageous, however, to employ a metal component **53** which is as thin as possible since this is the most expensive part of the composite facing of this invention. However, a thin metal component **53** generally should be backed by a suitable backing member **52** as in FIGS. 5C and 5D to provide sufficient support to prevent flexure which might damage the composite facing.

The backing member **52** may be formed of any conventional material known to be used for such purposes. For example, it may be metal, plastic, wood, gypsum type wall board, plywood, hardboard, particle board and like kinds of building materials. Preferably, the backing member **52** is a polymeric foam particularly a polyurethane foam and, most preferably, a rigid polyurethane foam. The use of a polymeric foam provides substantial advantages because of its thermally insulating and sound deadening nature.

The composite facing may be affixed to the backing member **52** by any conventional means. For example, it may be affixed by means of laminating, by means of adhesives, by cladding where the backing member is a metal or by any other desirable method.

The panel **50** shown in FIG. 5C has the composite facing of this invention on only one side **56** of the backing member **52.** This configuration is particularly adapted for use in building curtain wall wherein only one face of the panel **50** is visible. Therefore, a panel **50** constructed as in FIG. 5C could be employed in the curtain wall of FIGS. **1** and **2** in place of the panels **5** shown therein. For applications where both sides of the panel **50** are visible a panel constructed as shown in FIG. 5D could be employed. The only difference between the panel of FIG. 5D and the panel of FIG. 5C is that the composite facing of this invention is employed on both sides **56** of the backing member **52.**

The thickness of the backing member **52** may be set as desired in accordance with the intended application. The thickness of the metal component **53** of the composite facing should be maintained as thin as possible to conserve metal usage and reduce costs. it has been found in practice that the metal component **53** of the composite facing for a supported panel **50** may practially range in thickness from about 0.001 to 0.060.

The glass or ceramic-to-metal composite facing of this invention is generally formed by applying the glass or ceramic, for example, in the form of a fine powder or frit to the surface of the metal component **26** or **53** in any conventional manner and then firing the composite to melt and fuse the glass or ceramic and bond it to the metal component **26** or **53** by means of the alumina film on the metal surface. Normally, all deformation or forming of the metal component **26** or **53** is performed prior to the application of the glass or ceramic component **27** or **54.**

In practice, the most preferred means for applying the glass or ceramic component **27** or **54** is to spray a slurry of the glass or ceramic powder or frit in a suitable carrier, such as water, onto the surface of the metal component **26** or **53** and then fire the glass or ceramic. The particular firing temperature employed is dependent on the glass or ceramic which is used and does not form a part of the instant invention.

This invention may be embodied in other forms or carried out in other ways without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered as in all respects illustrative and not restrictive, the scope of the invention being indicated by the appended claims, and all changes which come within the meaning and range of equivalency are intended to be embraced therein.

What is claimed is:

1. In a building curtain wall comprising a plurality of substantilly vertically and horizontally disposed structural members affixed to the outside of a building, a plurality of decorative panels and windows supported by said structural members, a plurality of retaining members secured to said structural members for retaining said panels and said windows in place and a plurality of facing members covering said retaining members and being supported by said retaining members, the improvement wherein said facing members are formed of a glass or ceramic-to-metal composite comprising a glass or ceramic component bonded to a copper base alloy component comprising from about 2 to about 12% aluminum and the balance essentially copper, said copper base alloy component adapted to contact said retaining members.

2. In a building curtain wall as in claim **1,** the further improvement wherein said copper base alloy component comprises from about 2 to 10% aluminum, 0.001 to 3% silicon, up to 35% zinc and a grain refining element selected from the group consisting of iron up to 4.5%, chromium up to 1%, zirconium up to 0.5%, cobalt up to 1% and mixtures thereof, the balance essentially copper.

3. In a building curtain wall as in claim **2,** the further improvement wherein said copper base alloy component consists essentialy of 2.5 to 3.1% aluminum, 1.5

to 2.1% silicon, 0.25 to 0.55% cobalt, the balance essentially copper.

4. In a building curtain wall as in claim **3,** the further improvement wherein said retaining members are of channel configuration having a web section and side walls extending outwardly in the same direction from longitudinal edges of said web section and a longitudinally extending outside groove in each of said side walls and wherein said facing member is of channel configuration having a web section and side walls extending outwardly in the same direction from longitudinal edges of said web section and a longitudinal groove formed in each of said side walls extending inwardly toward each other thereby forming ribs which are adapted to seat in said grooves in said side walls of said retaining member.

5. In a building curtain wall as in claim **3** the further improvement wherein said panels are formed of a glass or ceramic-to-metal composite sheet wherein said composite sheet comprises at least one glass or ceramic component bonded to a copper base alloy component, said copper base alloy component having a major face and an opposing major face, said copper base alloy component comprising from about 2 to about 12% aluminum and the balance essentially copper said glass or ceramic component being bonded to at least one of said major face and said opposing major face of said copper base alloy component.

6. In a building curtain wall as in claim **5,** the further improvement wherein said copper base alloy component comprises from about 2 to 10% aluminum, 0.001 to 3% silicon, up to 35% zinc and a grain refining element selected from the group consisting of iron up to 4.5%, chromium up to 1%, zirconium up to 0.5%, cobalt up to 1% and mixtures thereof, the balance essentially copper.

7. In a building curtain wall as in claim **6,** the further improvement wherein said copper base alloy component consists essentially of 2.5 to 3.1% aluminum, 1.5 to 2.1% silicon, 0.25 to 0.55% cobalt, the balance essentially copper.

8. In a building curtain wall as in claim **5,** the further improvement wherein a backing member is affixed to the copper base alloy component of said composite sheet.

9. In a building curtain wall as in claim **6,** the further improvement wherein a backing member is affixed to the copper base alloy component of said composite sheet.

10. In a building curtain wall as in claim **7,** the further improvement wherein a backing member is affixed to the copper base alloy component of said composite sheet.

11. In a building curtain wall comprising a plurality of substantially vertically and horizontally disposed structural members, said structural members supporting a plurality of windows and panels, the improvement wherein said panels are formed of a glass or ceramic-to-metal composite sheet wherein said composite sheet comprises at least one glass or ceramic component bonded to a copper base alloy component, said copper base alloy component having a major face and an opposing major face, said copper base alloy component comprising from about 2 to about 12% aluminum and the balance essentially copper, said glass or ceramic component being bonded to at least one of said major face and said opposing major face of said copper base alloy component.

12. In a building curtain wall as in claim **11,** the further improvement wherein said copper base alloy component comprises from about 2 to 10% aluminum, 0.001 to 3% silicon, up to 35% zinc and a grain refining element selected from the group consisting of iron up to 4.5%, chromium up to 1%, zirconium up to 0.5%, cobalt up to 1% and mixtures thereof, the balance essentially copper.

13. In a building curtain wall as in claim **12,** the further improvement wherein said copper base alloy component consists essentially of 2.5 to 3.1% aluminum, 1.5 to 2.1% silicon, 0.25 to 0.55% cobalt, the balance essentially copper.

14. In a building curtain wall as in claim **11,** the further improvement wherein a backing member is affixed to the copper base alloy component of said composite sheet.

15. In a building curtain wall as in claim **12,** the further improvement wherein a backing member is affixed to the copper base alloy component of said composite sheet.

16. In a building curtain wall as in claim **13,** the further improvement wherein a backing member is affixed to the copper base alloy component of said composite sheet.

* * * * *