April 1, 1969 G. KRONE 3,435,573

BUILDING FACING MADE OF WEATHER-RESISTANT FACE PLATES

Filed Nov. 3, 1967 Sheet 1 of 7

Fig.1

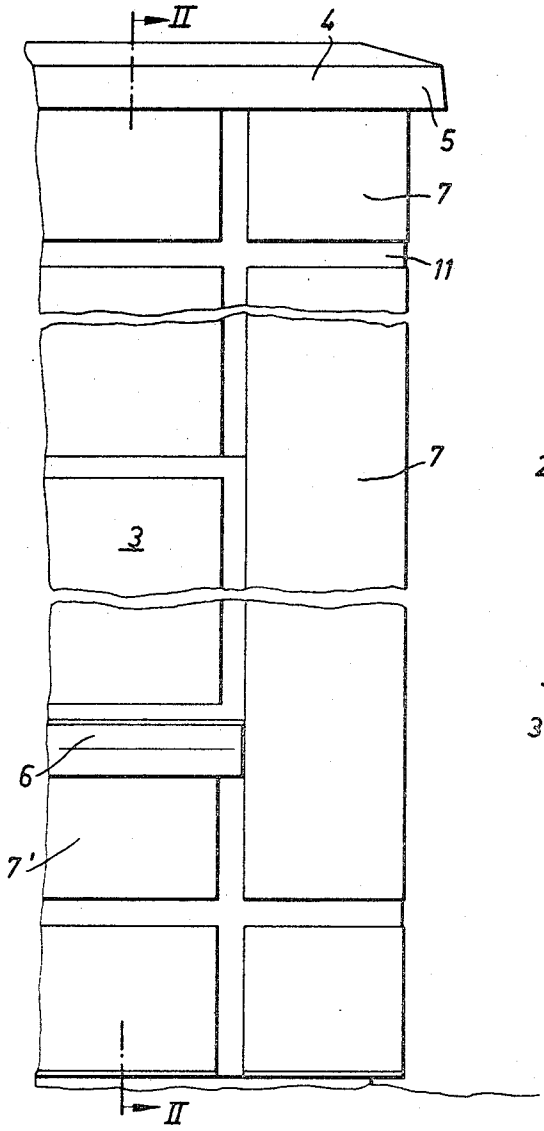
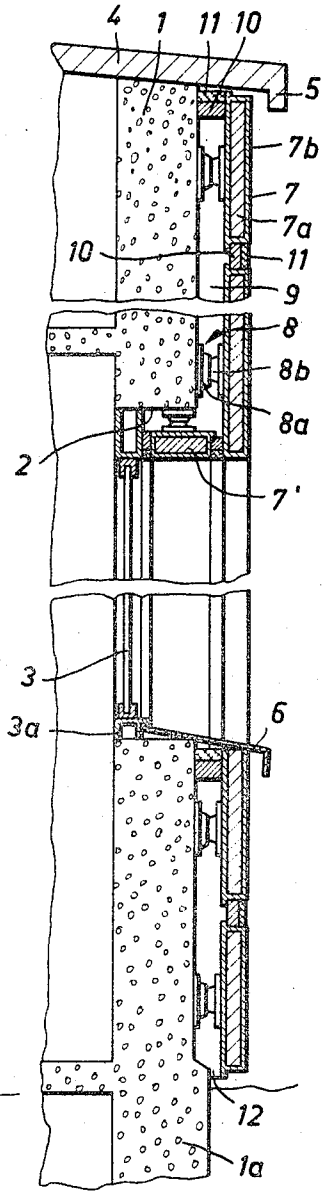


Fig.2



Inventor:
Gustav Krone
by
Edwin E. Greigg

Fig.3a

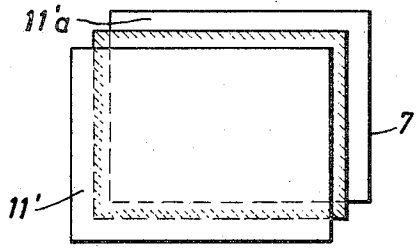
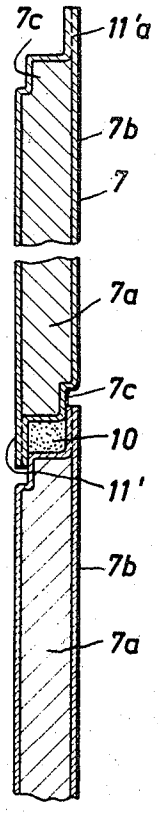


Fig.4



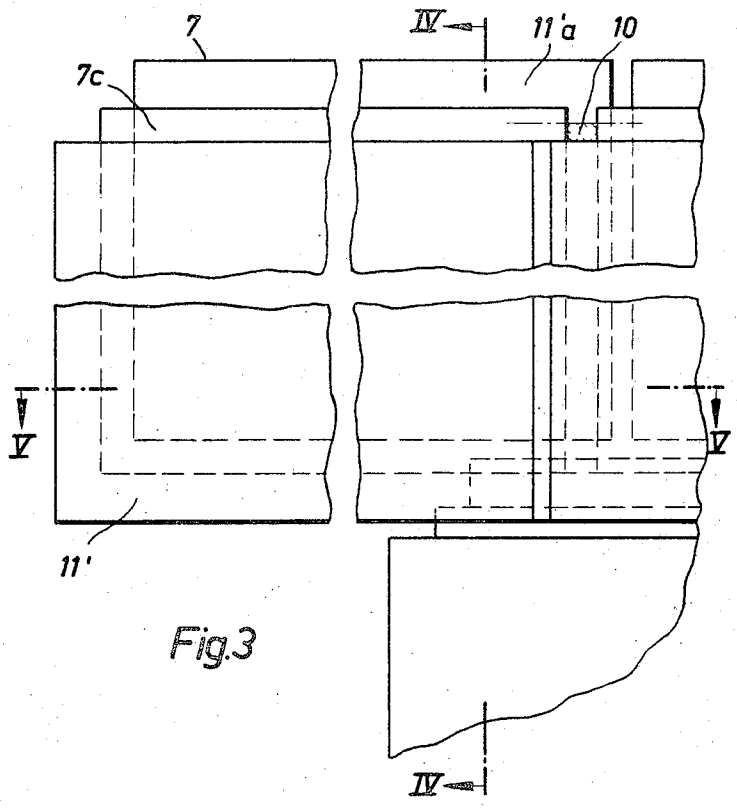
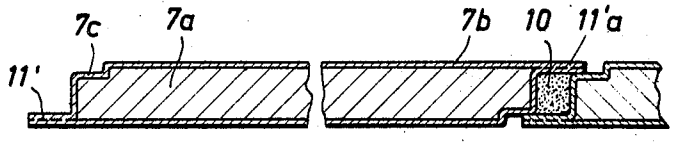


Fig.3

Fig.5



BUILDING FACING MADE OF WEATHER-RESISTANT FACE PLATES

Fig.6

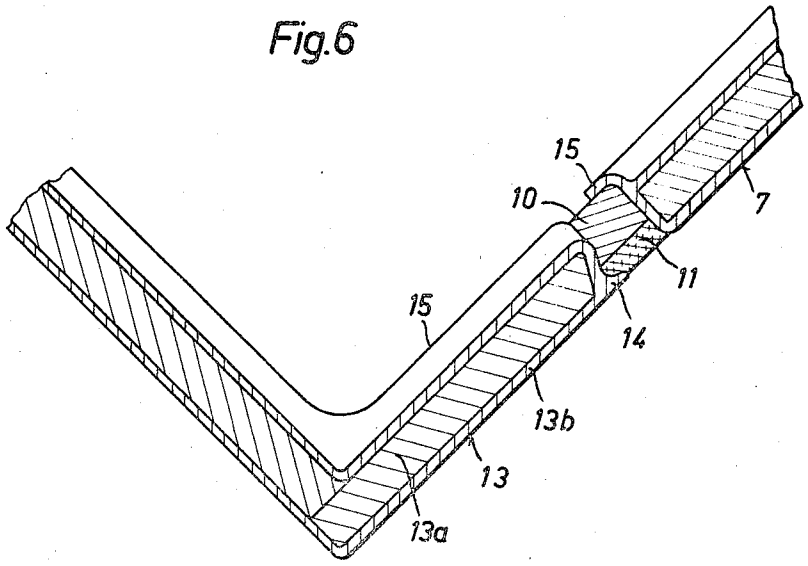


Fig.7

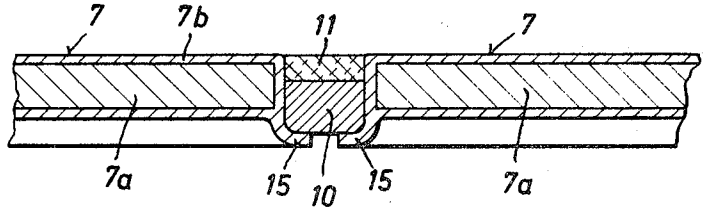


Fig.8

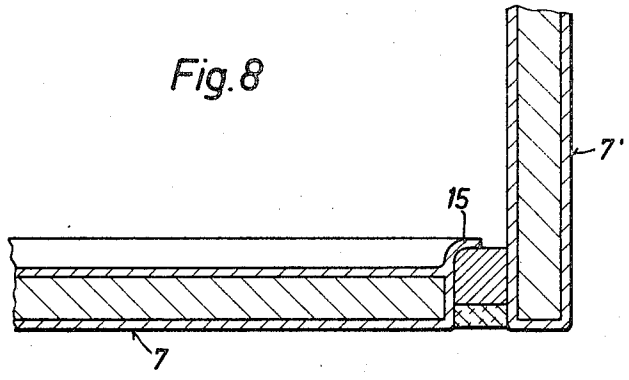


Fig.9

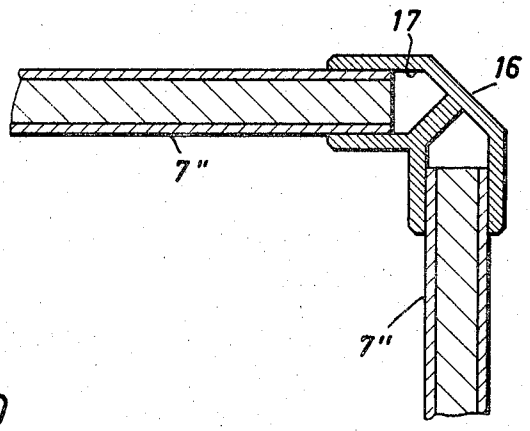


Fig.10

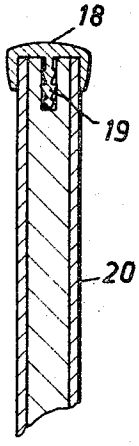


Fig.11

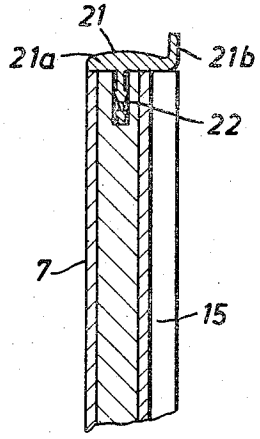


Fig.13

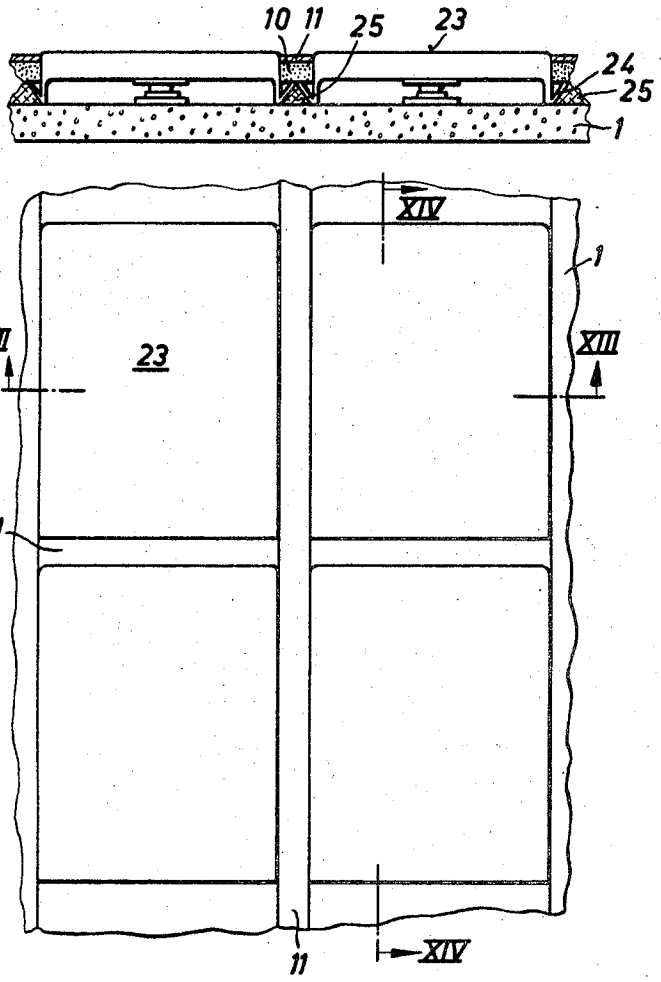


Fig.12

Fig.14

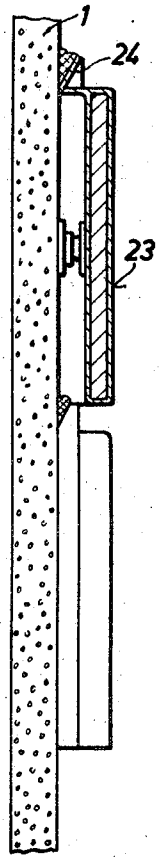


Fig. 15

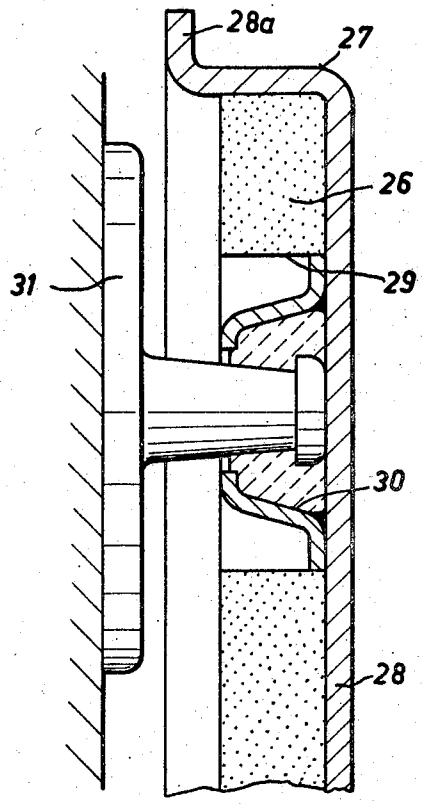
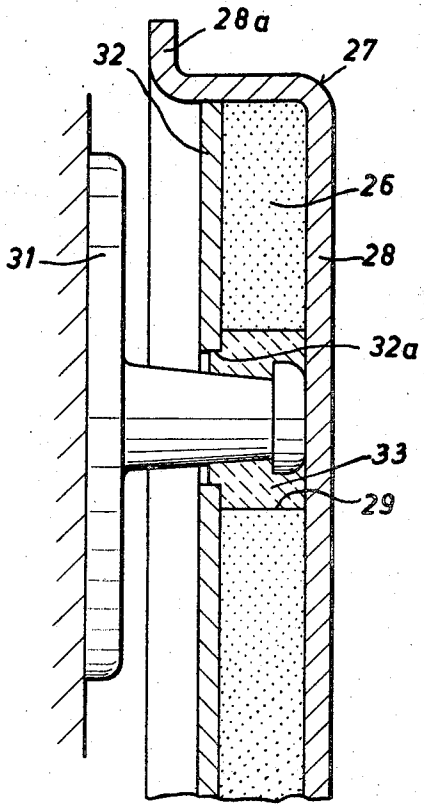


Fig.16



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3,435,573

BUILDING FACING MADE OF WEATHER-RESISTANT FACE PLATES

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Int. Cl. E04b 2/30
U.S. Cl. 52—272 8 Claims

ABSTRACT OF THE DISCLOSURE

A building facing formed of a plurality of individual face plates held in spaced relation from the building wall by means of spacers which at the same time serve as securing means for the plates; each plate comprises an inner heat-insulating core layer and an external cover layer; air-tight sealing means inserted between the adjoining edges of adjacent plates; the outer face of the building wall and the inner face of the facing define an intermediate air space which communicates with the external atmosphere only through openings provided adjacent the lower end of the facing.

BACKGROUND OF THE INVENTION

This invention relates to a building facing made of weather-resistant plates which are secured substantially parallel to, and spaced from, a building wall by means of spacers secured thereto; the inside face of the facing and that of said wall define an intermediate air space.

Building facings, made of weather-resistant plates that are not mounted on the building wall in a face-to-face engagement but are spaced therefrom, are known in the art. Thus, it is known to provide building walls, especially those facing north or west, with supports such as wooden grates carrying in a fish-scale arrangement overlapping thin plates made of slate or asbestos cement for the purpose of preventing the penetration of moisture into the building wall and at the same time providing an intermediate air space which permits a "breathing" of the wall. Building facings of this type have a great number of air passages in the facing causing circulation of the air in the intermediate air space. This air circulation is by itself not an undesirable phenomenon since it carries away the moisture that condensates in the air space and thus affords protection for the supporting grates against early decay due to moisture and mold formation.

It is further known to make facings of stone plates supported by adjustable holders spaced from the wall. The holders ensure that the stone face plates are in exact alignment even if there are irregularities in the external wall surface.

Since the weather-resistant plates used in known facings are either relatively thin or have, despite their substantial thickness, only negligible heat-insulating properties, the temperature in the air space between the facing and the building wall is strongly affected by weather conditions. In the winter, moisture emanating from the inside of the building or released by the building wall itself, freezes in the external layers of the wall thus preventing breathing therethrough and causing a deterioration of the heat insulation of the transversally wet building wall.

It is further known to provide the external building wall with a layer of heat-insulating material and to cover this layer with mechanically strong plates which form a front shell against mechanical stresses and adverse weather conditions. These facings too, are disadvantageous in that the moisture emanating from the wall accumulates in the heat-insulating layer and adversely affects the heat-insulating properties thereof.

SUMMARY OF THE INVENTION

A principal object of the invention is to provide an improved external building facing which obviates the disadvantages of the prior art and which is of the type formed by weather-resistant plates disposed at a distance from the wall ensuring the breathing of the wall even at low winter temperatures.

Briefly stated, according to the invention, the external building facing, formed of a plurality of weather-resistant face plates disposed at a distance from the wall to form therewith an intermediate air space, has individual, insulating structural face plates which are provided at least at their external surface with a moistureproof, weather-resistant and shockproof cover layer and are sealed air-tight with respect to adjacent plates. Air-tight seals are also inserted between the upper and lateral edges of the building facing and the building wall leaving an opening only along the lower edge of the facing. The seal between adjacent face plates comprises preferably a soft elastic material of low heat conductivity such as foam material having closed pores.

The novel building facing ensures that at external temperatures of 5° F. below zero and internal building temperatures at 60° F. the internal surface of the building wall is maintained at temperatures above the freezing point. Under these conditions breathing of the wall is not impaired and consequently, the wall is free to emit moisture which then may condensate at the inside of the facing. If temperatures are extremely low, the moisture may freeze on the facing or, if temperatures are higher, it may flow downward and be discharged near the ground.

The invention will be better understood and further advantages will become more apparent from the ensuing detailed specification of several exemplary embodiments taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a building portion provided with a facing according to the invention;

FIG. 2 is a sectional view taken along line II—II of FIG. 1;

FIG. 3 is an elevational view of a particular face plate showing parts of adjacent face plates attached thereto;

FIG. 3*a* is a front elevational view of a single plate according to FIG. 3;

FIG. 4 is a sectional view taken along line IV—IV of FIG. 3;

FIG. 5 is a sectional view taken along line V—V of FIG. 3;

FIG. 6 is a sectional plan view of a corner of the facing;

FIG. 7 is a sectional view taken across a seal between two adjacent face plates;

FIG. 8 is a sectional view of a corner of the facing constructed differently from that shown in FIG. 6.

FIG. 9 is a sectional view of a further embodiment of a corner structure;

FIGS. 10 and 11 are sectional views of the edge structures of heat-insulating face plates according to the invention;

FIG. 12 is a front elevational view of a further embodiment of a building facing according to the invention;

FIG. 13 is a sectional view taken along line XIII—XIII of FIG. 12;

FIG. 14 is a sectional view taken along line XIV—XIV of FIG. 12; and

FIGS. 15 and 16 are schematic sectional views of two further embodiments of the heat-insulating face plates according to the invention.

DESCRIPTION OF THE EMBODIMENTS

Turning now to FIGS. 1 and 2, there is schematically shown a portion of the novel building facing formed of juxtaposed heat-insulating face plates disposed along an external building wall including a window opening.

The external building wall **1**, made of concrete, includes a window opening **2** in which there is inserted a window **3** supported substantially by the inner portion of the horizontal edge faces of opening **2**. The schematically shown roof **4** projects over the wall **1** and is provided with a rain baffle or other conventional gutter structure **5**. From the lower window frame there extends a water guide plate **6** projecting beyond both wall **1** and the novel facing now to be described.

Each heat-insulating face plate **7**, forming an element of the building facing comprises a core layer **7***a* made of a light-weight material having good heat-insulating properties, such as hard foam, bound wood pulp, or the like. The core layer **7***a* is surrounded at all sides by a preferably fiber-reinforced cover layer **7***b* made of weather-resistant synthetic material including dyestuff and fire-resistant additives. A polyester resin reinforced with glass fibers has been found advantageous in that it contains relatively little filling material.

For securing the heat-insulating face plates **7** to the building wall **1** there are provided spacers **8** which, in the embodiment shown in FIG. 2, are formed of two parts. One part **8***a* is secured to the concrete wall **1** and comprises a cavity (not shown) which is accessible from the front and which is slightly flared towards the wall **1**. The other part **8***b* of the spacer **8** is fixedly secured to the inner face of face plate **7** and terminates in an enlarged head portion (not shown) which extends into the said cavity with a clearance at all sides and is cemented therein by means of a settable or hardening material that fills out the cavity. The air layer **9** enclosed in the space between the external face of concrete wall **1** and the inner face of the face plates **7** should be heat-insulating and consequently should be stationary. In order to ensure the air tightness of the building facing, thus preventing undesirable movements of air layer **9**, there are provided between adjacent face plates **7** soft-elastic seals **10** which, during installation, are slightly resiliently compressed and are provided at their external faces with weather-resistant cover strips **11** substantially flush with the outer cover layers **7***b*.

Similar seals are provided between the face plates **7** and **7'**, the latter being used to cover the window openings **2** and between face plates **7'** and the window frame **3***a*. Further, the entire building facing is, at its upper edge, provided with seals **10** and cover strips **11** disposed between the uppermost row of face plates **7** and the concrete wall **1**. The lateral, vertical edges of the building facing are also sealed in the same manner with respect to the building wall **1**. Along the bottom edge of the facing there remains a gap **12** between the lowermost row of face plates **7** and an enlarged base portion **1***a* of the concrete wall **1**. Through gap **12** the pressure difference between the insulating air layer **9** and the external atmosphere is equalized and the condensation water which may accumulate at the inside of the facing is discharged.

Based on weather conditions prevailing in central Europe or in the Eastern United States, the above described building facing may advantageously have specifications as follows.

The insulating face plates **7** may have an overall thickness of 15–20 millimeters of which 12–17 millimeters are taken up by the heat-insulating core layer **7***a* and approximately 1.5 millimeters (on each side of the core) by the cover layer **7***b*. The insulating air layer **9** may have a thickness of 20–40 millimeters, while the concrete wall **1** may be of a thickness of 12–15 centimeters. A concrete wall, a building facing and an air layer of the above specifications have, as a unit, heat-insulating properties that

correspond to those of a brick wall 51 centimeters thick. Such assembly ensures that even at external temperatures of 5° F. below zero the temperatures of the external face of the concrete wall **1**, having a plastered inner face, will remain above the freezing point if the temperature inside the building is maintained at 60° F. or somewhat higher.

The properties set forth hereinabove ensure that the concrete wall **1**, which long after its installation continuously releases moisture, maintains its breathing capabilities even in severe winter weather. The condensated moisture precipitates on the inside of the face plates; the accumulated liquid flows downward and is discharged through the opening **12**.

As the first step in assembling the building facing, the spacers **8***a* are secured to the concrete wall **1**, for example, by means of steel pins (not shown). Then the spacer parts **8***b*, which have been previously fixedly secured to the face plates **7**, are, by exerting pressure thereon, introduced into the cavities of the spacer members **8***a*. These cavities, as set forth hereinbefore, are filled with a hardening material, such as putty or mortar. Before seting of this material, the interconnected spacer parts **8***a* and **8***b* are adjustable with respect to one another; thus a cancellation of dimensional irregularities in the face plates or in the wall face is possible by means of manual adjustment of the suspended face plates. Thereafter, the seals **10** and then the cover strips **11** are inserted in place.

Due to their relatively light weight, the individual face plates **7** may have an area of approximately 10 square feet without necessitating the use of additional installing or securing means. Consequently, once the spacer parts **8***a* are in place on the concrete wall, the assembly of the facing may progress very rapidly.

Tests have shown that the heat expansion of the heat-insulating face plates **7** of the type described hereinabove and illustrated in FIG. 2 is very small and, consequently, even at relatively large temperature changes there are no substantial forces generated in the plane of the plates. Also, a loosening of the plates with respect to the spacers or a loosening of the spacers themselves may not occur.

Turning now to FIGS. 3, 3*a*, 4 and 5, there is shown another embodiment of the face plates and their arrangement. The cover layer **7***b* on each side of the face plate **7** has an overhanging portion or flange **11'** (on one face of plate **7**) and a flange **11'***a* (on the other face of plate **7**). Adjacent flanges **11'** and **11'***a* there extends, spaced by the thickness of the plate **7**, a continuous step **7***c* the height of which is substantially equal to the thickness of flanges **11'** or **11'***a*. As best seen in FIGS. 3 and 3*a*, on one face of face plate **7** the flange **11'** extends along two adjoining sides thereof, while on the other face of plate **7** the flange **11'***a* extends along the other two adjoining sides. As best seen in FIGS. 4 and 5, the face plates **7** are juxtaposed in such a manner that their respective flanges along adjoining sides repose on steps **7***c* so that cover layers **7***b* on either face of adjacent plates are coplanar and the plates themselves are in an overlapping relation. Further, between adjoining edges of juxtaposed face plates **7** tubular channels are formed which contain seals **10**. Here the cover strips **11** are omitted; their function is performed by flanges **11'** and **11'***a*. The dimensions of steps **7***c* permit a slight play of the plates in the plane thereof, thus, the elastic seals **10**, which are inserted in a pre-compressed condition, may be eventually compressed to a greater or lesser extent.

Instead of separately inserting the elastic seals **10** they may be bonded—even before the assembly of the facing—along the corner edge formed by the side of plate **7** and the flange **11'***a*. The seal **10** preferably projects somewhat beyond the ends of the flanges **11'***a* to fill out the space at locations where points of three face plates meet.

For forming the corner edges of the building facing, V-shaped corner face plates **13** may be used (FIG. 6) having a one-piece cover layer **13***b* pressed onto the core layer **13***a* formed by two planar portions arranged in

V-shape. The corner plate **13** is provided at its outer side with a ledge **14** which is formed by pressing together the edge of the outer and inner cover layers **13***b*. Ledge **14** forms, together with the similarly made flange **15** of the adjacent face plates **7**, an intermediate space for receiving the elastic seal **10** and the cover strip **11**. Ledge **14** and flange **15** respectively overlap the strip **11** and seal **10** holding them securely in place.

Turning now to FIG. 7, there are shown two identical adjoining face plates **7** each provided at its inner face with a peripheral flange **15** which first rises normal to the plane of the plate and then extends laterally away therefrom in a plane parallel thereto. The flanges **15** on adjacent sides of juxtaposed plates extend toward one another and delimit partially the rear of the intermediate space for receiving the elastic seal **10** and cover strip **11**. After the assembly of the face plates, the seal **10** is pressed into the space between two adjacent plates and into engagement with flanges **15**. Seal **10** is subsequently provided with cover strip **11** to ensure an air-tight seal between the face plates **7**. It will be obvious to those skilled in the art that instead of a two-part sealing assembly formed by the elastic seal **10** and the outside cover strip **11**, a unitary seal strip may be used which may be made of a foam material having a closed-cell outer face.

Turning now to FIG. 8, there is shown a corner structure particularly adapted for the lining of window openings. As seen, the face plate **7'** is plain while the face plate **7** is of the type described in connection with FIG. 7. Its flange **15** serves to partially delimit from the rear the intermediate space adapted to receive the seal **10** and the strip **11**.

In an embodiment shown in FIG. 9, the corner edge of the facing is formed by a particular profile member **16** made of a shock-resistant material such as a fiber-reinforced plastic. The member **16** includes two channels **17** disposed at 90° with respect to one another and adapted to receive the plain terminal portions of two face plates **7''**. The plates may be bonded to the profile member **16** by an adhesive. The external corner of member **16** may be chamfered or rounded. In order to improve the heat insulation of the member **16**, the inside thereof may be provided with an additional foam layer.

Since the desired measurements of the facing are seldom exact multiples of the dimensions of the component face plates as manufactured, in most cases at least one face plate in each row has to be cut down to size. The cut face plates have, at their edge, an exposed core layer which should preferably be closed off by auxiliary means. Such closing means are shown in FIGS. 10 and 11.

The closing member **18** (FIG. 10) has an externally rounded U-section and carries at its inner face a medial stem **19** which is externally terraced and is driven into a slot cut in the exposed edge of the core layer of a plain face plate **20**. The member **18** may then be bonded to the plate **20** by means of an adhesive. Thus, the core layer is securely sealed.

Turning now to FIG. 11, there is shown a closing member **21** particularly adapted to be used with a flanged face plate **7** according to FIG. 7. Member **21** has an L-shaped section comprising a long thick body portion **21***a* and a shorter and thinner leg **21***b*. The member **21** is held, like member **18**, in the slotted exposed edge of the core layer of face plate **7** by means of an externally terraced stem **22** extending from the body portion **21***a*. When in place, the member **21** extends over the entire cut edge of the face plate while its shorter leg **21***b* constitutes a continuation of the peripheral flange **15**.

FIGS. 12–14 show a further embodiment of the heat-insulating face plate indicated here at **23**. Each plate **23** is provided with a circumferential flange **24** of a V-shaped section which, with its edge, directly engages the wall **1**. Between the back sides of two adjacent V-shaped flanges **24** there is disposed a sealing bead **25** made of elastic material or porous putty. Beads **25** divide the air space between the face plates and the wall into individual, hermetically closed compartments or chambers. These chambers, however, may, if so desired, communicate with one another through small openings in said beads at predetermined locations.

Turning now to FIG. 15, there is shown a face plate arrangement wherein the heat-insulating core **26** of the face plate **27** is shielded by a fiber-reinforced, weather-resistant cover **28** only at its outer face and at the edges. The face of the core **26** turned towards the wall is freely exposed. The heat-insulating core **26** in face plate structures of this type is preferably made of a weather-resistant foam material such as a hard PVC foam having a closed-cell surface. The fiber-reinforced plastic cover **28** is in the shape of a flat bowl with outwardly bent flanges **28***a*. Cover **28** gives the face plate **27** the necessary strength and also protects it against external shocks or impacts. The heat-insulating core **26** includes a cavity **29** in which securely nests a cup-shaped support member **30** having an opening in its base and a flange directly welded or bonded to the inner face of cover **28**. There is further provided a second support member **31** which is secured to the concrete wall and which has a head portion extending through the said opening in the base of cup **30** and is securely held within the cup by means of putty or mortar.

In a modified structure shown in FIG. 16, the inner face of the heat-insulating core **26** may be shielded by a plate **32** glued thereto and having an opening **32***a* disposed in alignment with a cavity **33** in core **26**. The head portion of the support member **31** extends into cavity **33** filled with putty or mortar. The heat insulating core **26** of the face plate **27** shown in FIG. 16 may be formed of a foam material of lesser weather-resistant properties or of a bound fiber material securely bonded to the cover **28** and to the plate **32**. Core **26** has a sufficient structural strength to prevent a removal of the face plate **27** from the support **31**. The entire weight of the face plate **27** is transmitted from the inner plate **32** to the support member **31**. Since plate **32** rests on the sides of the bowl-shaped cover **28**, there are no appreciable shearing forces that could exert strain in the plane of contact between the heat-insulating core **26** and the inner plate **32**.

Although several embodiments of the invention have been depicted and described, it will be apparent that these embodiments are illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. A building facing formed of a plurality of face plates secured to a building wall in spaced relation thereto to define an intermediate air space, the improvement comprising,

(A) face plates having

(1) a heat-insulating core including

(a) an inner surface adjacent said wall,

(b) an outer surface remote from said wall,

(c) side edges interconnecting said inner and outer surfaces,

(2) a water-tight, weather-resistant and structurally strong cover extending over and conforming to at least said outer surface and said side edges,

(B) securing means fixedly attached to said wall and to each of said face plates to support them in a spaced relation with respect to said wall,

(C) sealing means disposed between adjoining face plates and between said wall and the upper and lateral marginal portions of said facing to seal said air space in a substantially air-tight manner and

(D) means defining at least one opening between the lower marginal portions of said facing and said wall to maintain communication between said air space and the outer atmosphere.

2. A building facing as defined in claim 1 wherein said face plates include, at least on one face thereof, a peripheral flange extending along all the sides of said face plates, said flange rises normal to the plane of said face plates and terminates in an outwardly bent portion extending parallel and away from said plane.

3. A building facing as defined in claim 1 wherein the face plates forming the corners of said building facing have a V-shaped cross-section.

4. A building facing as defined in claim 1 including additional sealing means disposed between said wall and said face plates to divide said air space into a plurality of compartments.

5. A building facing as defined in claim 1 wherein said sealing means between adjoining face plates includes

(A) an elongated seal made of soft elastic material and

(B) a weather-resistant cover strip extending over said seal at the outside of said facing and bonded to said seal.

6. A building facing as defined in claim 1 wherein two adjoining sides on one face of said face plate are provided with a peripheral flange coplanar with said one face, and two opposite adjoining sides on the other face of said face plate are provided with a peripheral flange coplanar with said other face.

7. A building facing as defined in claim 6 wherein said face plates are provided with two peripheral steps each extending parallel to said flanges and separated therefrom by the thickness of said plates, said steps have a height substantially equal to the thickness of said flanges.

8. A building facing as defined in claim 7 wherein said face plates are juxtaposed in such a manner that flanges of adjacent face plates mutually overlap and engage said steps, said sealing means is disposed between two overlapping flanges.

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U.S. Cl. X. R.

52—303, 406, 442, 508