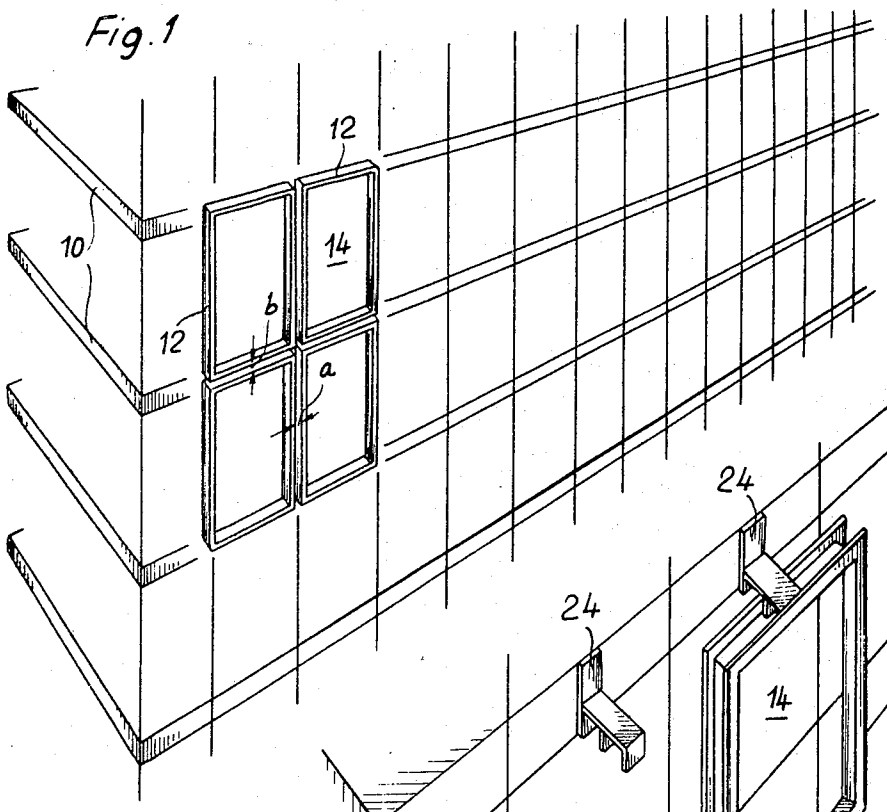
Feb. 13, 1973 P. JORDAN 3,715,848

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 1

Fig. 1



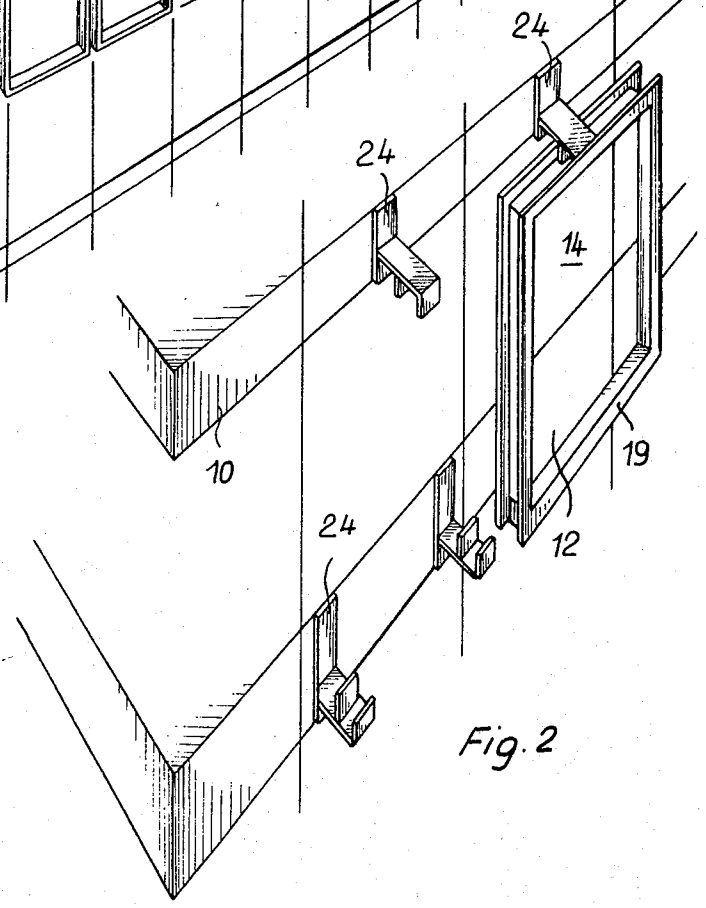


Fig. 2

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 2

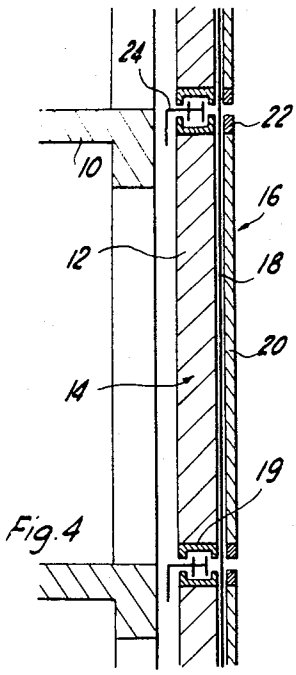


Fig. 4

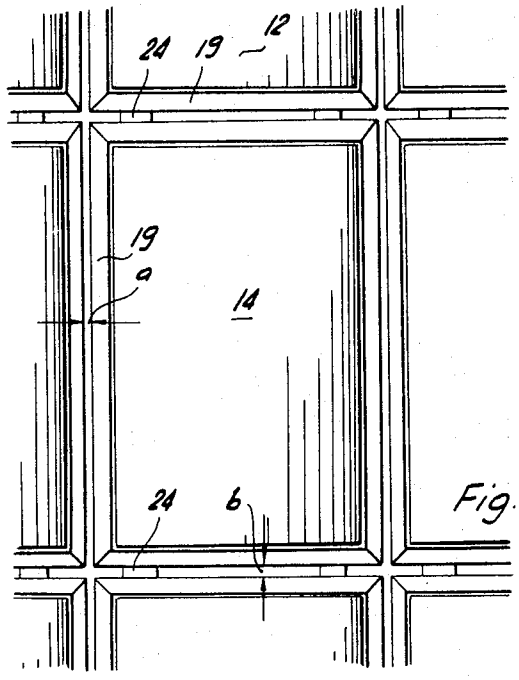


Fig. 3

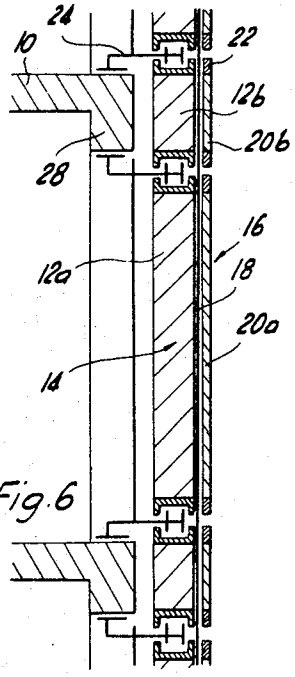


Fig. 6

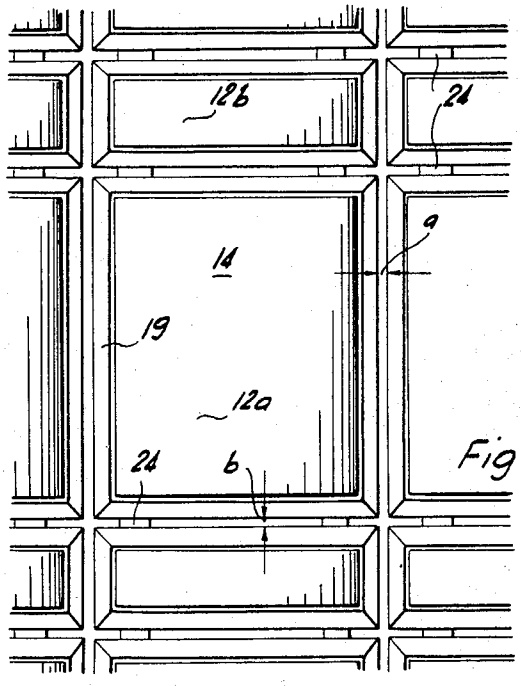
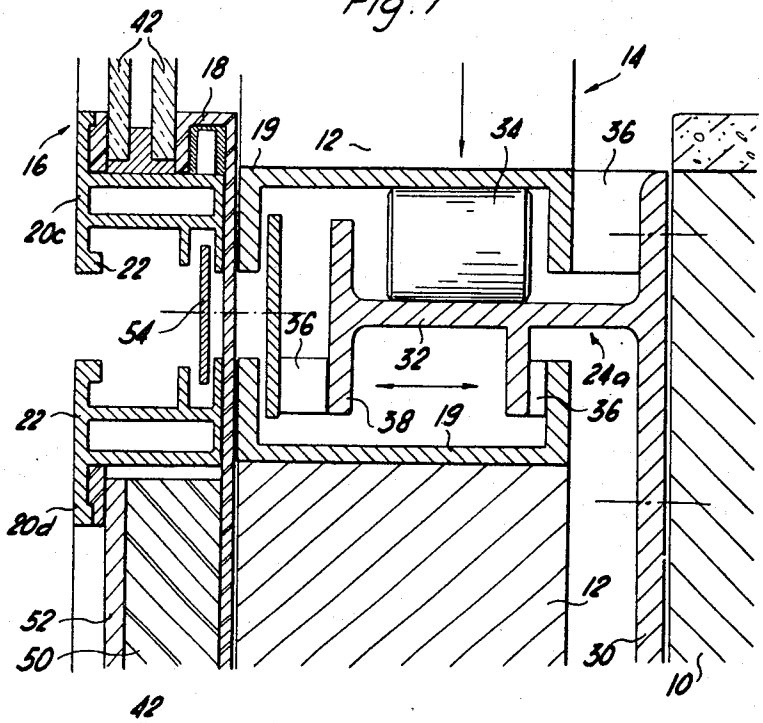


Fig. 5

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 5

Fig. 7



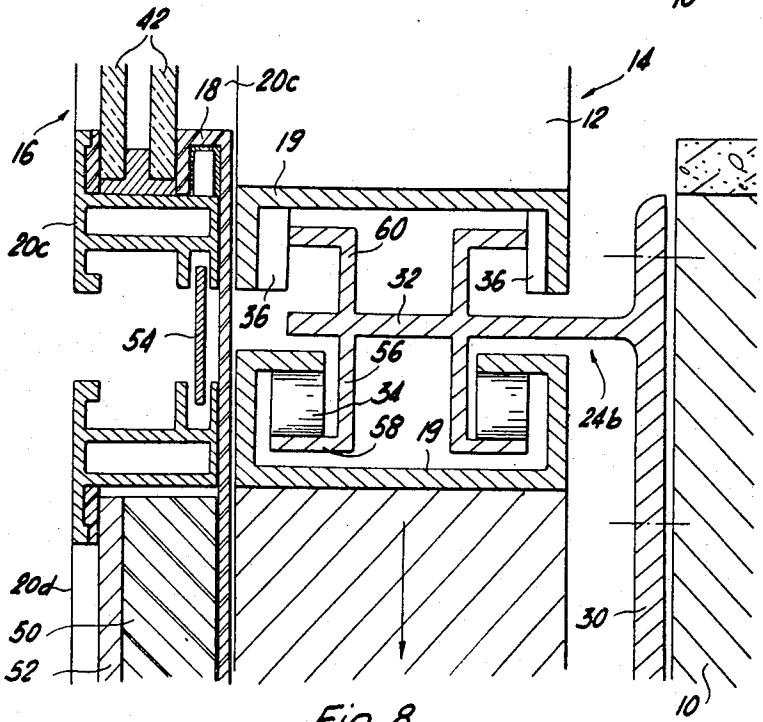
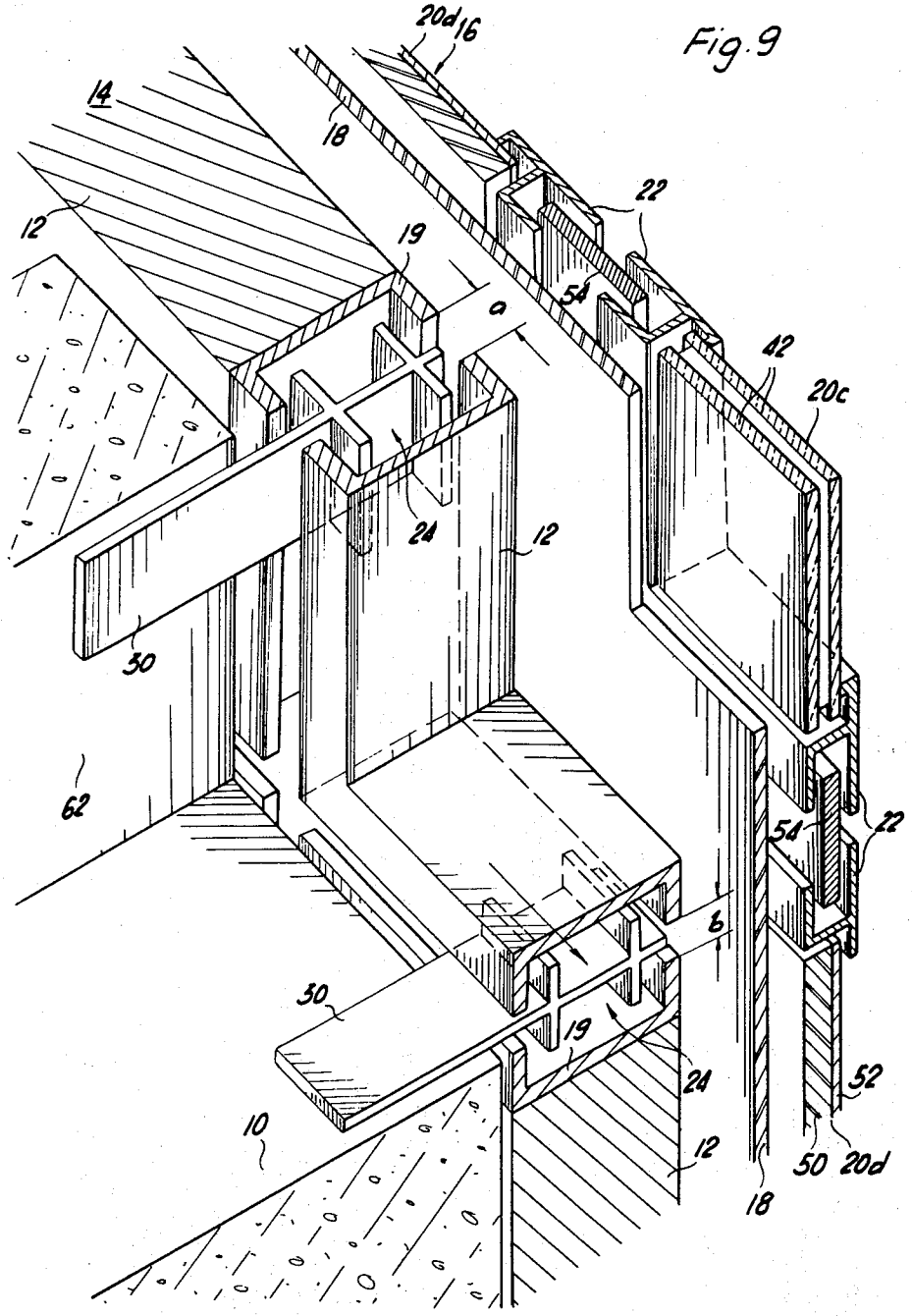


Fig. 8

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

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Fig. 9



MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 5

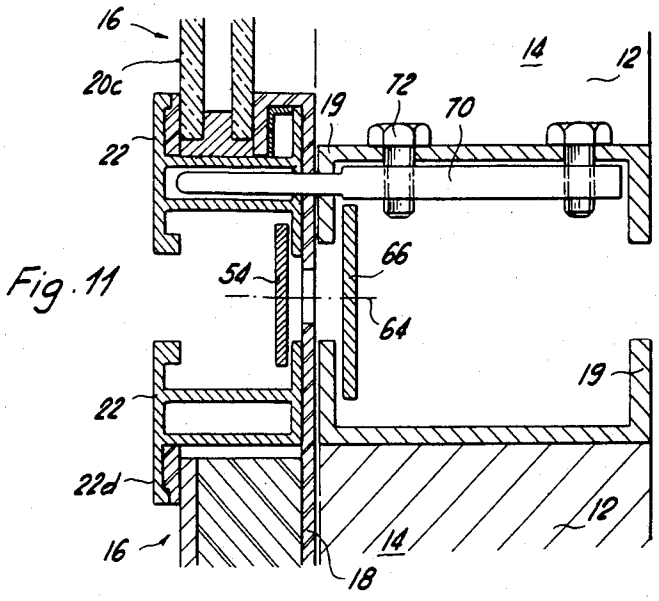


Fig. 11

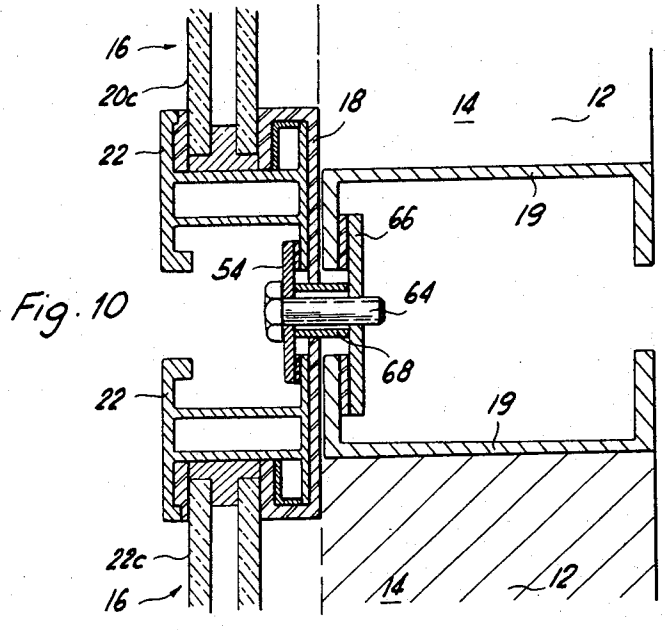


Fig. 10

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 6

Fig. 12

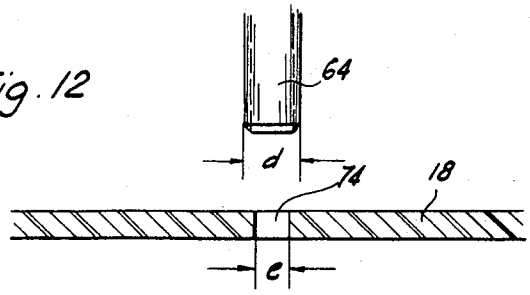


Fig. 13

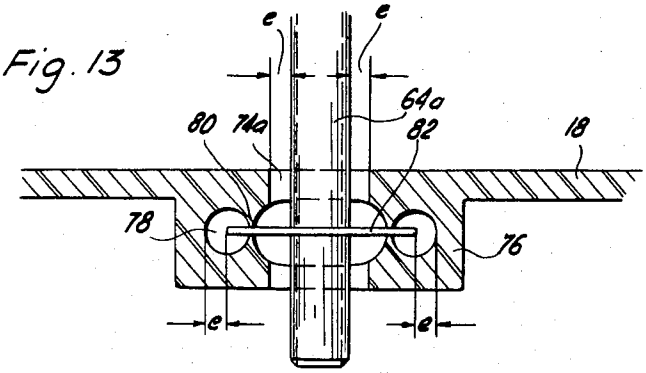
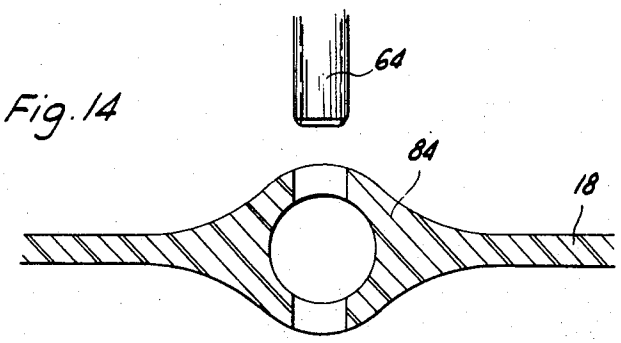


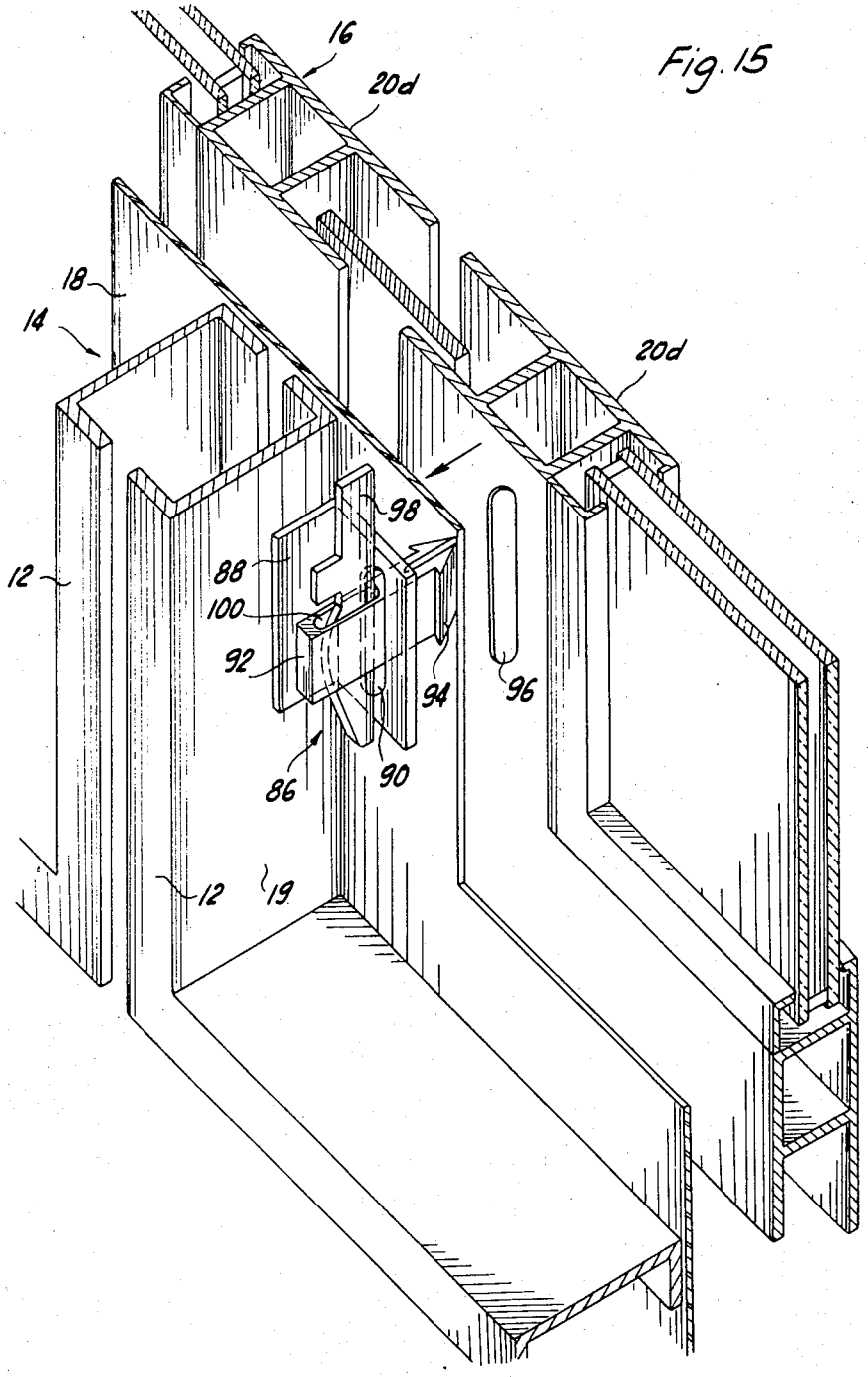
Fig. 14



MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

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Fig. 15



MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 8

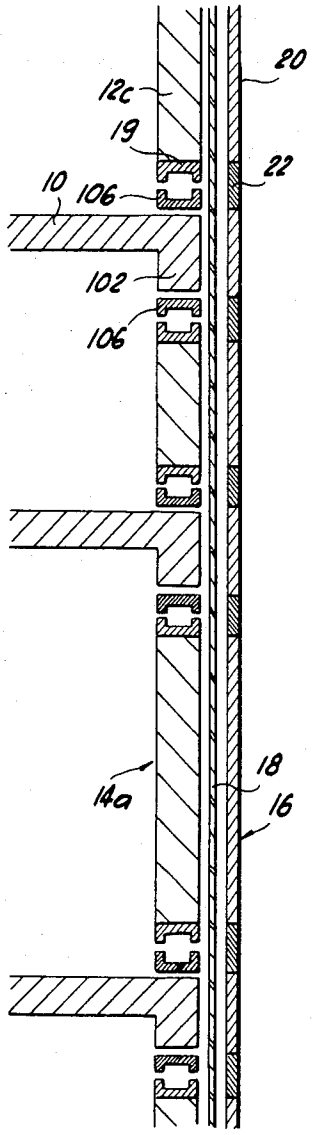


Fig. 16

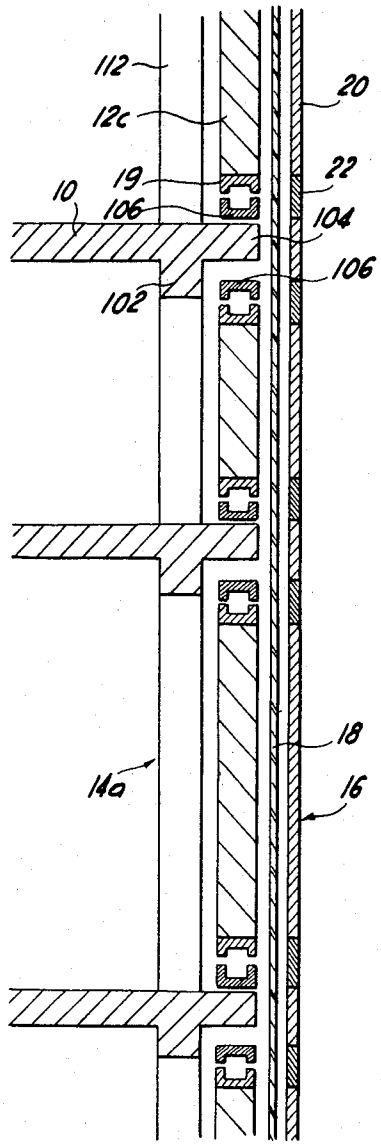
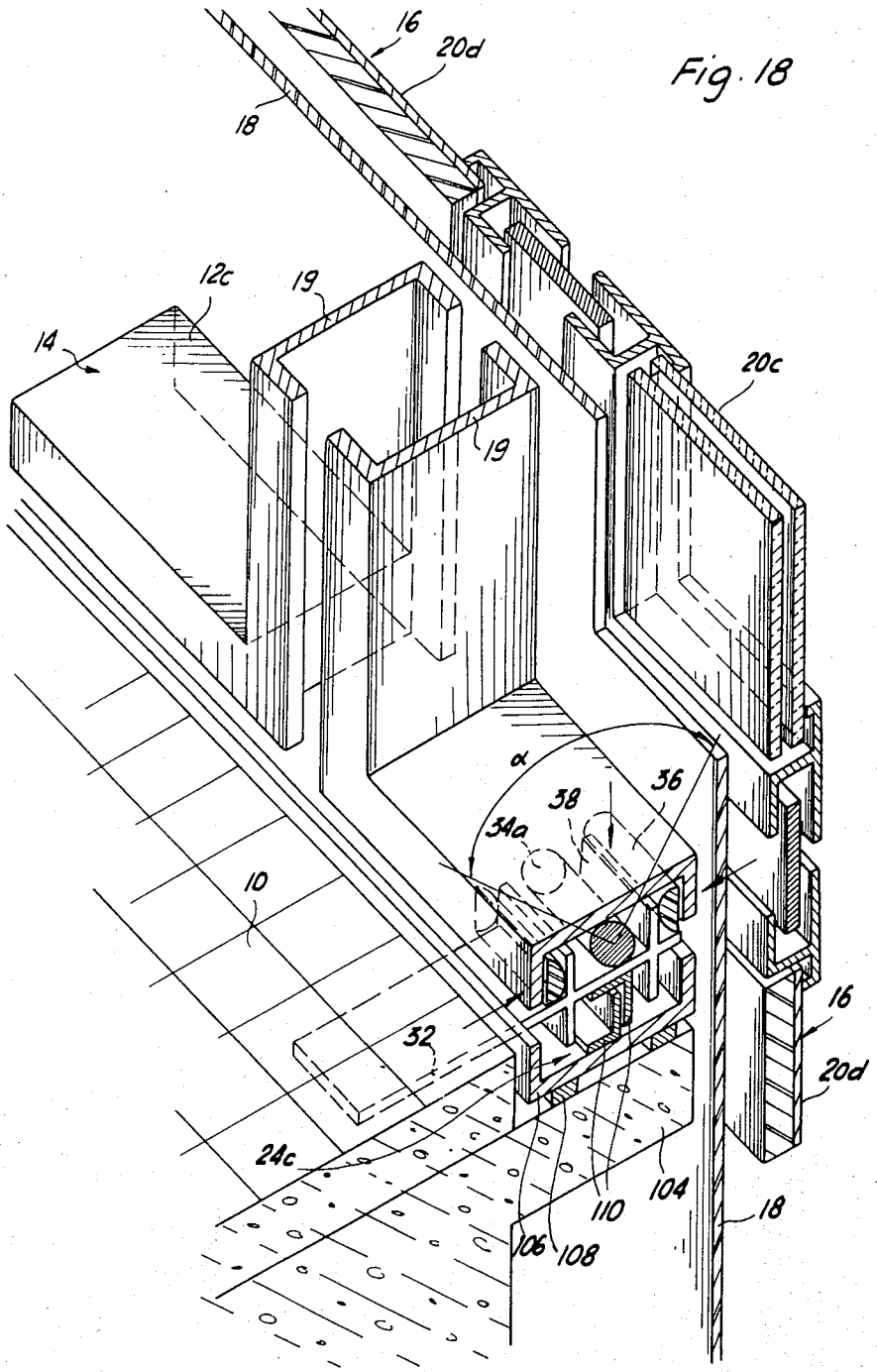


Fig. 17

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

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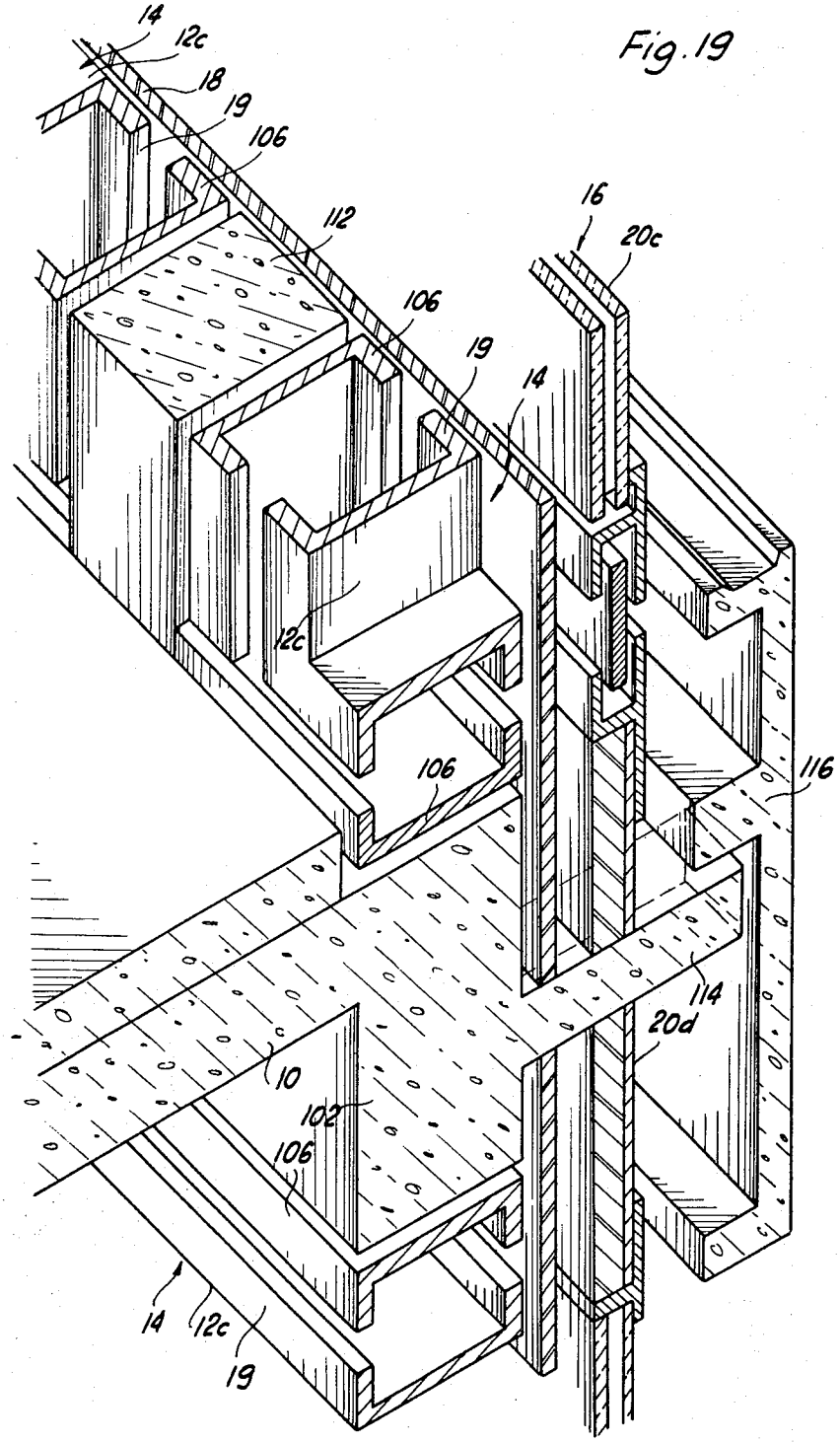
Fig. 18



MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 10

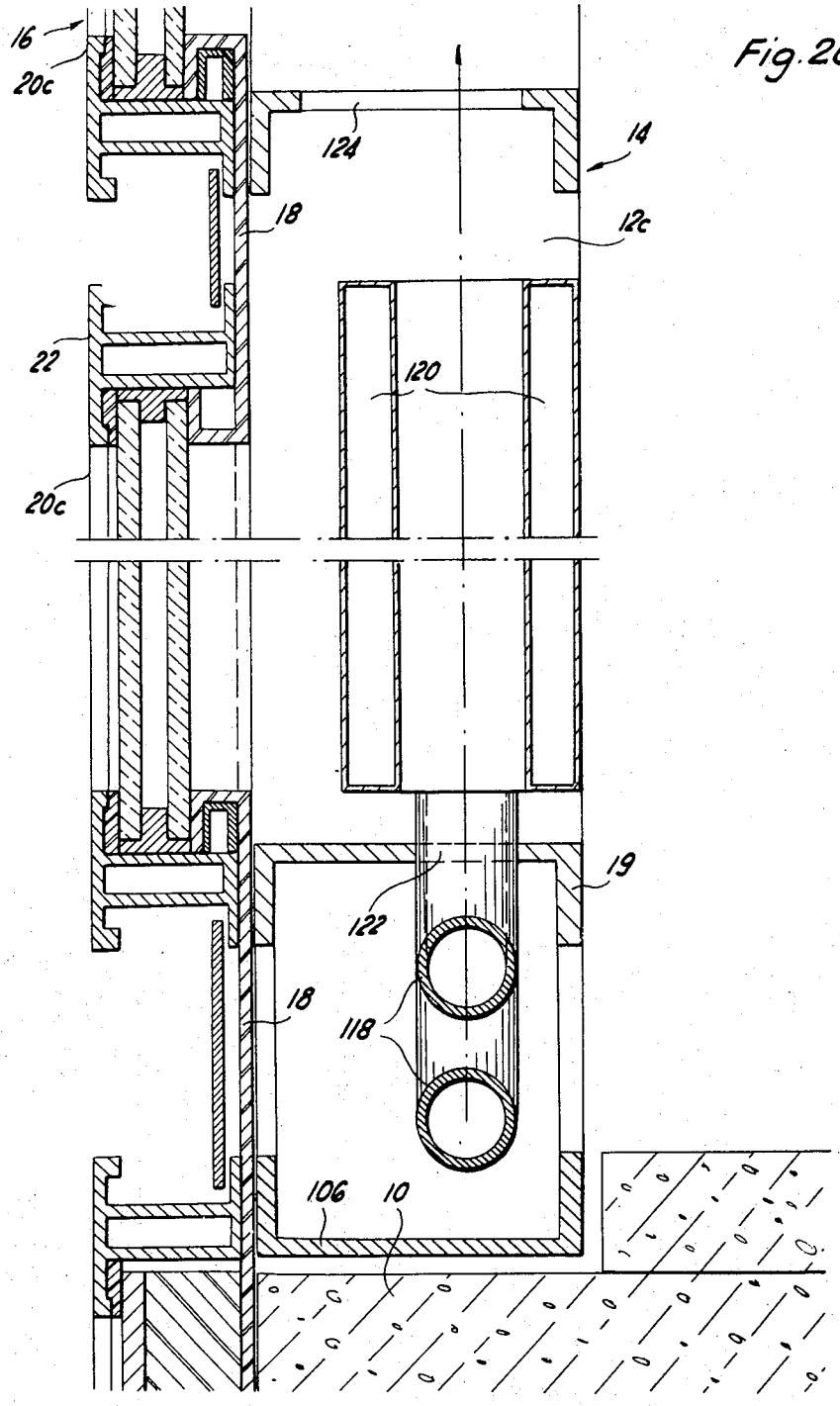
Fig. 19



MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 11

Fig. 20



MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Filed April 15, 1970 12 Sheets-Sheet 12

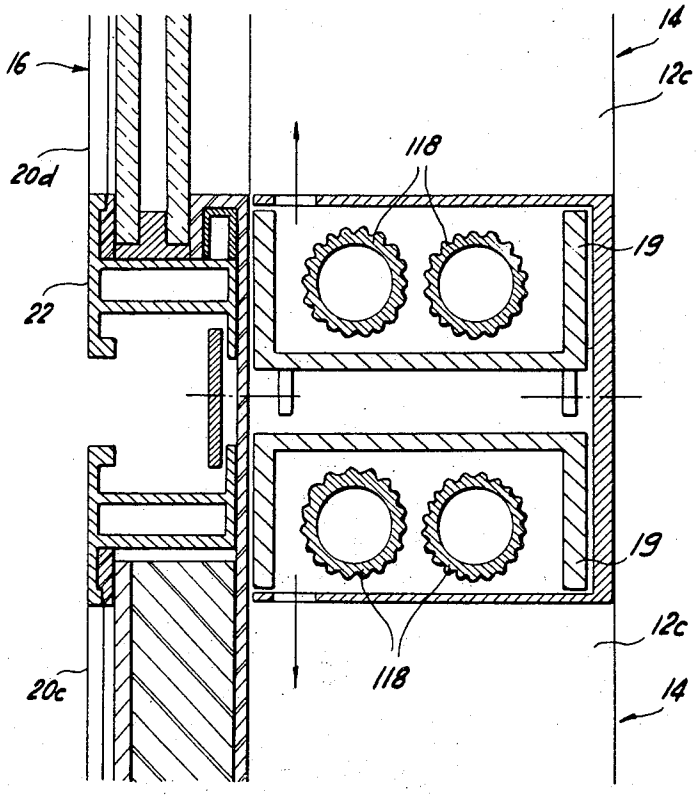


Fig. 21

United States Patent Office 3,715,848 Patented Feb. 13, 1973

3,715,848

MULTIPLE LAYER OUTSIDE WALL OF A BUILDING OR THE LIKE

Paul Jordan, Zahringerplatz 2, Constance, Germany

Filed Apr. 15, 1970, Ser. No. 28,614
Claims priority, application Switzerland, Apr. 18, 1969, 5,857/69
Int. Cl. E04b 1/62, 2/88
U.S. Cl. 52—235 23 Claims

ABSTRACT OF THE DISCLOSURE

A multiple layer outer wall for a building or the like which embodies an outer wall layer portion and an inner wall layer portion as well as an insulation skin arranged between both of the aforementioned wall portions. This insulation skin is constructed as a membrane consisting of an elastic elongatable, tear resistant and thermally insulating material which at least is primarily covered both towards the outside of the building as well as toward the inside of the building by the respective outer and inner wall layer portions. Furthermore, the insulation membrane or skin is free of interruptions defining parting lines or separation joints or at least possesses less separation joints or parting lines than one of both wall layer portions, and additionally, the inner wall layer portion is assembled from a plurality of substantially rectangular wall elements which are laterally arranged adjacent one another with horizontal spacing and/or vertical spacing.

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved multiple layer outside or external wall for a building, structure or the like, which is of the type comprising an outer wall layer portion and an inner wall layer portion as well as an insulation skin or membrane arranged between both of the aforementioned wall portions.

Such type multiple layer outside walls for buildings are known to the art, for instance as described in the German article entitled "Nichttragende leichte Aussenwande-Vorhangwande," publication "Bauen mit Aluminium 1966/1967," Aluminium-Verlag G.m.b.H., Dusseldorf, Germany, December 1966/1967, pp. 8 to 22. With all external or outer walls which in cross section do not uniformly consist of "breathable" material, in other words are not formed of brick, rather possess a certain multiple layer arrangement or approximate such, it is desirable to arrange the thermal insulation layer generally as far to the outside as possible, whereas on the other hand, to arrange the layer with high water vapor-diffusion resistance, the so-called steam or vapor lock, as far as possible towards the inside, in order to avoid the danger of condensation of water vapor within the layer aggregation. Yet, this tendency for constructing the outer wall in this manner—with large facade surfaces—is associated with several difficulties. Thus, for instance, it is difficult to construct the wall cross section at the expansion joints from a heat insulating, that is to say, porous non-compact material. Quite to the contrary, there is used throughout the entire depth of the cross-section a highly sturdy or solid, in fact generally a wear resistant, in other words compact, preferably metallic material. Apart from the foregoing, then, at the regions of the expansion joints the thermal installation short-circuit, the so-called heat bridge, is generally also therefore quite considerable, because there the metallic profile material tends to decisively appear in "pairs," for instance with groove and spring or resilient means. Thus, there appears a considerable accumulation of heat conducting material.

Once again, experience has shown that the inside situated vapor lock does not tend to be satisfactory always just at those locations where in the internal rooms or spaces of the building an increase of the moisture content is not permissible, even if such increase is only temporary. This is especially the case, for instance, in rooms utilized for the fabrication of sensitive electrical or electronic or similar devices, especially if these rooms cannot or only insufficiently be climatized or vented, for instance because no climatization occurs during the weekends when there is a stoppage in work.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a new and improved multiple layer outer wall construction for a building or the like which no longer possesses the abovementioned drawbacks of the prior art constructions.

Another, more specific object of the present invention relates to an improved multiple layer outside wall for a building, structure or the like, which is relatively simple in construction, economical to manufacture, and easy to erect.

Now, in order to implement these and still further objects of the present invention, which will become more readily apparent as the description proceeds, the heretofore mentioned inventive multiple layer outer or outside wall for a building or the like is manifested by the features that the insulation skin is constructed as a membrane consisting of an elastic elongatable, tear resistant and thermally insulating material which is covered at least over its major part towards the outside of the building as well as toward the inside of the building by the aforementioned respective outer and inner wall layer portions. Furthermore, the insulation skin or membrane is free of joints or separations or at least possesses less interruptions defining such separation joints than one of both wall layer portions. Additionally, the inner wall layer portion is composed of a number of substantially rectangular wall elements which are arranged laterally adjacent one another with horizontal and/or vertical spacing.

It has furthermore been found that for advantageous reasons of technology and economy, the vapor locking layer in the layer aggregation of the outer wall—in contrast to the previously explained tendency—can be arranged relatively far towards the outside. The insulation skin preferably functioning as a vapor locking layer is constructed from a membrane consisting of an elastically elongatable, tear-resistant and thermally insulating material. This membrane should be formed with as few joints or parting lines as possible and, because of expansion of the building and the facade, should be formed of an elastically elongatable material, plastic for instance.

Furthermore, the insulation skin should also fulfill the function of sealing off the inside from the outside at all locations where the layer aggregation of the wall, covering such insulation skin, towards the outside and/or towards the inside possesses expansion joints, because both of these layer complexes of the wall can be extensively non-elastic, for instance if they are formed of metal. As a result, the construction of the expansion joints can be considerably simplified and rendered more inexpensive. Provision need only be made for a more or less "unintentional" self-aeration of the layer complex or aggregation disposed towards the interior of the building, especially its outer region; then there can be obtained a saving on any type of absorptive inner plaster or inner coating. The abovementioned layer aggregation, then, can be, for instance, formed throughout its entire cross-sectional depth from frame members formed of metallic profile

material. In so doing, that portion of the cross-sectional depth which otherwise would be used for the inner plaster or inner coating, becomes of advantage for the moment of inertia of the profile material-frame means, that is to say, its bending resistance or stiffness against wind pressure. This is the case if the layer aggregate or complex situated towards the interior of the building, which is of advantage, is the wall portion considered by itself with regard to static conditions or primarily for absorbing loads. Further advantages of the new outside wall of the building or structure, are for instance the following:

As the material for the outer layer complex covering the expandable plastic layer there can thus be chosen a highly corrosion and weather-resistant special aluminum alloy which can easily be eloxadized or anodised. On the other hand, for the layer complex serving as the covering towards the inside of the building there can be chosen such a metal alloy which, in the first instance, tends to readily fulfill the strength requirements.

The expandable and extensively jointless i.e. continuous membrane which, for instance, is welded together at the building site from webs of plastic into a larger unit, functions especially then as a considerable heat or thermal lock if this membrane is relatively thick or consists of a number of layers and/or its surfaces are mounted "hollow" at both sides. Additionally, its sound dampening action is also then relatively great.

A skin or membrane formed of plastic and having relatively few parting lines or separation joints, especially free of joints, permits the use of, for instance, two different metals at the wall layer portions disposed to both sides thereof, without fearing any electro-chemical corrosion, even if the position of the metal at the outer wall layer portion with respect to the electro-chemical series is considerably removed from the position of the other metal, in other words the metal used for the inner wall layer portion. The presence of the insulation skin permits the use of steel profile material and/or steel sheet metal for the inner wall layer portion, and for the outer wall layer portion light profile material and/or light metal sheet material.

The outer building wall of the present invention is particularly suitable for such structures which, according to the static principle, consist of story or floor ceilings supported by struts (supports) in which the static loads are essentially taken up by a steel or steel concrete skeleton and not by massive walls. In fact, the outside wall for buildings of the present invention can be used as curtain-type or draped facades, especially such which can be prefabricated in the factory. Viewed from the outside of the building or structure, in all of the embodiments the outer wall can be such that the struts and ceilings are visible, that is to say, only the intermediate regions are filled by the outside wall. On the other hand, it is also possible that only the struts or instead of such only the course of the ceiling remain visible. Finally, it is also possible that the building outside wall of the invention hides behind it the entire supporting skeleton, that is to say the struts or columns together with the story ceilings, in that it surrounds the entire building in the manner of a skirt.

The feature of the invention that the inner wall layer portion is assembled from a plurality of rectangular wall elements arranged laterally adjacent one another with horizontal spacing and/or vertical spacing results in the fact that there is prevented a direct force-transmitting contact of the marginal portions with such neighboring wall elements. The direct contact can be eliminated for all separation joints or only for the vertical joints or only for the horizontal separation joints of the wall elements. As a result there are provided the following advantages:

(a) A considerable saving in weight and cost for the used profile rod material;

(b) A simplified support (anchoring) at the concrete or brick work insofar as the support need not be displaceable (compare the publication entitled "Aluminum," Dusseldorf (December 1965), special volume "Bauen mit Aluminium 1965," picture 22 appearing at page 9 thereof);

(c) The outer building wall is absolutely "noiseless" because in its supporting layer, in other words at the inner wall layer portion there do not appear any displaceable joints or the like, that is, there cannot occur any "noisy working" of the building outside wall with pronounced fluctuations of sun radiation and so forth;

(d) There is prevented a transmission of sound energy from sound sources within the building by means of the curtain wall or front wall and a radiation of this energy into other spaces or rooms of the building, because there does not exist any direct force-transmitting contact between the wall elements of the inner wall layer portion;

(e) There is prevented right from the outset the danger of a "continuous tearing" of the outside wall of the building with a crack or tear from a storm by virtue of the subdivision of the inner supporting wall layer portion into independent wall elements;

(f) Only slight demands are placed upon the expansibility of the insulation skin of the outside wall of the building by virtue of the aforementioned subdivision of the inner supporting wall layer portion; by virtue of this subdivision the expansion movements of those construction components, for instance bolts, which pass through the insulation skin or layer in order to support the outer wall layer portion are reduced to a minimum. The flexible insulation skin or layer can thus be fabricated from a material of, increased Shore Hardness Test and wear resistance, increased ruggedness and cheaper quality.

In many instances the subdivision of the inner wall layer portion into a plurality of similar wall elements further provides a rationalization of the building or construction operation, particularly since experience has shown that from year to year there must be taken into consideration larger tolerances in the dimensions of the building skeleton.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein there are depicted various exemplary embodiments of inventive multi-layer building outer wall means, especially used for steel concrete skeleton-structures, and wherein:

FIG. 1 is a perspective fragmentary view of a first forwardly suspended or positioned outside wall of a building in which there are only shown mounted four wall elements of the inner layer wall portion consisting of a multiplicity of such wall elements;

FIG. 2 is a perspective fragmentary view of a second forwardly mounted outside wall of a building, with there being shown only mounted one slab element of the inner layer wall portion;

FIG. 3 is a fragmentary side view of the inner layer wall portion of a third forwardly mounted or preset outside wall of a building;

FIG. 4 is a sectional view of the outside building wall depicted in FIG. 3;

FIG. 5 is a fragmentary side view of the inner layer wall portion of a fourth preset outside building wall;

FIG. 6 is a sectional view of the outside building wall depicted in FIG. 5;

FIG. 7 is a sectional view of an attachment device for a forwardly positioned or preset outside building wall;

FIG. 8 is a sectional view of a further embodiment of attachment device for a forwardly suspended outside building wall;

FIG. 9 is a perspective cross-sectional view of the joint location of four wall elements of a further embodiment of outside building wall;

FIG. 10 is a fragmentary vertical sectional view of a multi-layered outside building wall in which the one outer layer wall portion is connected via a bolt member with an inner layer wall portion;

FIG. 11 is a fragmentary vertical sectional view of a further outside building wall in which a distance or spacer bolt member is arranged between the outer and the inner layer wall portions;

FIGS. 12–14, inclusive, depict in cross-sectional view respective different types of coupling arrangements between a bolt member and the insulation skin or layer;

FIG. 15 is a perspective view of a further connection device between the outer and the inner layer wall portion;

FIGS. 16 and 17 depict in vertical section two adjusted outer building walls in which the wall elements of the inner layer wall portion is adjusted between parts of the building support constructions;

FIG. 18 is a perspective cross-sectional view of the joint location of a number of wall elements of a further embodiment of outside building wall;

FIG. 19 is a perspective cross-sectional view of a further embodiment of outside building wall, wherein the wall elements of the inner layer wall portion are inserted between the story or floor ceilings, beams and columns, and which possesses a cantilever support extending through the insulation skin and the outer layer wall portion;

FIG. 20 is a fragmentary vertical sectional view of a further outside building wall, the wall element of which is equipped with a heating installation; and

FIG. 21 is a vertical horizontal sectional view of a further embodiment of outside building wall, the wall elements of which possess vertically arranged heating installations.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 illustrate in schematic, perspective view the support construction of a building or structure which is constructed as a steel concrete skeleton; this support construction is to be covered with a multi-layered outer building wall. Such multi-layered outer building wall is to be secured to the illustrated story ceilings **10** or other elements, such as columns, supports or the like, of the support construction.

In FIGS. 1 and 2 there have only initially been shown the wall elements **12** of the inner layer wall portion **14** of the multi-layered outer building wall which is to be secured to the story ceilings **10**. As will be described and illustrated in greater detail hereinafter, the external or outer building wall, however, further incorporates an outer or external layer wall portion **16** and an insulating skin or layer **18** arranged between both of the aforementioned wall portions **14** and **16**.

Considering now the inner wall portion layer **14**, it will be recognized that such, as illustrated, is subdivided into a multiplicity of wall elements **12**, preferably possessing, in each instance, a frame member **19** which, in cross section, has a substantially U-shaped configuration, the legs of such U-shaped frame **19** at the end of the corresponding wall element **12** extending towards the outside. It is to be understood that these wall elements **12** can be constructed quite differently, depending upon the most varied type of functions assigned to them. For instance, they can be constructed as sound, or thermal insulating elements, can possess openings for doors and windows, and so forth. In each case, they serve as the load absorbing component, in other words the so-called "supporting" component of the outside wall of the building or structure which, for instance, has to absorb the wind pressure. As far as the frame members **19** of the wall elements **12** are concerned, these are metallic profile frames. Such preferably consist of steel-profile material, the surface of which has been improved according to conventional techniques. The strength values, also the modulus of elasticity of the employed steel alloys and the moment of inertia of the employed frame cross-section are high enough in order to impart the previously described bending stiffness to the outer building wall against the pressure of the wind and, thus, to maintain the previously described load tolerances.

As far as the insulating skin or layer **18**, it will be understood that such is composed of an elastic, expansible membrane formed of plastic which hardly conducts heat. Such a membrane is, for instance, welded and/or adhesively bonded at the building site into a unitary structure which is free of joints and is formed from plastic webs delivered as rolled material. In so doing, the horizontal connection seams are preferably welded, whereas an adhesive can be used for the lengthwise seams between the individual webs. The skin, that is to say, the insulation layer, preferably extends without any joints about all four sides of the building or structure and likewise again without joints from the foundation up to the roof. The insulation skin or layer is covered towards the outside of the building by the outer wall layer portion **16**. In the case of windows the insulation layer is provided with openings or recesses at appropriate regions thereof.

As for instance best shown by referring to FIGS. 4 and 6, the outer wall layer portion **16** preferably likewise is composed of individual elements **20** which advantageously correspond in their dimension or size and number to the wall elements **12**. These elements **20** preferably also possess frame means **22** consisting of weather resistant and decorated eloxadized light metal profile members. The elements **20** furthermore can, analogous to the wall elements **12** of the inner wall layer portion **14**, be appropriately constructed as window elements or insulating elements.

In the exemplary embodiment of the invention outside wall for a building, structure or the like as shown in FIGS. 1 and 2, there have only been conveniently illustrated four wall elements **12** of the inner wall layer portion **14**, wherein each such wall element **12** is suspended or mounted at attachment devices **24**. The wall elements **12** are not in mutual direct contact with one another, rather are separated from one another by expansion joints, specifically possessing a vertical spacing *a* and a horizontal spacing *b*, as best shown by referring to FIG. 1.

In FIG. 2 there is schematically illustrated the attachment of an individual suspended or forwardly arranged wall element **12** of the inner wall layer portion **14**. To this end lower attachment devices **24** are arranged at the story ceilings **10**, as shown, which support the load of the portion of the multi-layered outside building wall belonging to the wall element **12**. Further attachment devices or members **24** are provided at the top of the depicted wall element **12**, these attachment devices **24** not being loaded by the weight of the outside wall of the buildings. The top attachment devices together with the lower attachment devices **24** serve to absorb the load appearing through wind pressure and wind suction.

FIGS. 3 and 4 illustrate an embodiment of a forwardly placed multiple-layered outside building wall as viewed from the outside and in cross section, respectively. The inner wall layer portion **14** consisting of the wall elements **12** is connected via the attachment devices **24** with the floor or story ceilings **10** of the building-support construction. The vertical dimension of the individual wall elements **12** practically corresponds to the height of a story. These individual wall elements **12** are preferably arranged in such a manner that they are more or less flush with the upper edge of the individual floor ceilings. The attachment devices **24**, which have only been schematically illustrated, are constructed such that they perform a double function. On the one hand they support the wall element **12** of the inner wall layer portion **14** disposed thereabove and, on the other hand, retain the lower situated wall element **12** in position essentially only against wind pressure and wind suction. Continuing, it will be recognized that bordering from the outside against the

inner wall layer portion **14** are the insulation skin or membrane **18** and the outer wall layer portion **16**. In the illustration of FIG. 3 the insulation skin or membrane **18** and the outer wall layer portion **16** have been conveniently omitted. The outer wall layer portion **16** is also likewise subdivided into individual elements **20**, the dimensions of which essentially correspond to those of the wall elements **12** of the inner wall layer portion **14**. As further shown in FIG. 3, the wall elements **12** of the inner wall layer portion **14** are arranged at a vertical spacing *b* from one another and further at a horizontal spacing *a* from one another.

FIGS. 5 and 6 depict a further outside wall of a building, structure or the like, in analogous showing to the arrangement of FIGS. 3 and 4. In contrast to the previously discussed embodiment, here the individual wall elements **12** and the elements **20** of the inner wall layer portion **14** as well as the outer wall layer portion **16** are not constructed to possess a height corresponding to that of a floor or story, rather are subdivided, as shown. Accordingly, the wall elements **12***a* of the inner wall layer portion **14** possess a vertical dimension which approximately corresponds to the free spacing between the story ceilings **10**. On the other hand, a smaller wall element **12***b* possesses approximately a vertical dimension corresponding to that of a support member **28** provided for each floor ceiling. The elements **20***a* and **20***b* of the outer wall layer portion **16** once again correspond to the dimensions of the wall elements **12***a* and **12***b*, respectively, of the inner wall layer portion **14**. Consequently, there is provided an irregular breakdown of the outside building wall which still coincides with the dimensions of the building-support construction and which almost reproduces such from the outside.

FIG. 7 depicts an attachment device or mechanism **24***a* which, on the one hand, serves for supporting a wall element **12** of the inner wall layer portion **14** and, on the other hand, serves to retain a neighboring wall element **12** against wind pressure and wind suction. The attachment device **24***a* incorporates an anchoring portion **30** by means of which such attachment device is secured to the floor ceiling **10**. In the exemplary embodiment under consideration, this occurs by threadably attaching the support from the outside to the end face of the floor ceiling. A vertically protruding holding or support member **32** merges with the anchoring portion **30** and upon which there is supported via a roller body member **34** the wall element **12** situated thereabove. The lower situated wall element **12** of the inner wall layer portion **14**, that is to say, the wall element disposed at the lower level, is supported only against horizontally acting forces, such as for instance wind pressure and wind suction, via elastic spacer members **36** at the vertical shoulders **38** of the holder or supporting member **32**.

FIG. 7 furthermore depicts details concerning the construction of an outer or external wall layer portion **16** as well as further details of the arrangement of the insulating skin or membrane **18**. The outer wall layer portion **16** possesses, for instance, a window element **20***c* which, in turn, incorporates a prefabricated double-glass arrangement **42** which is tight around its edges. The double-glass arrangement **42** is fixedly arranged in the frame unit **22**. A further element of the outer wall layer portion is constructed as an insulation element **20***d* and possesses an insulation plate member **50** arranged in the frame member **22**. Insulation plate member **50** is covered towards the outside by means of a cover layer **52** formed of an anodised or eloxadized light metal. A displaceable cover member **54** bridges the gap between the two elements **20***c* and **20***d* of the outer wall layer portion. Furthermore, it serves to attach the outer wall layer portion to the connecting or attachment device **24**, as will be more fully explained in conjunction with FIG. 9.

Continuing, it is to be understood that the attachment device **24***b* shown in FIG. 8 corresponds essentially in its structure to the attachment device **24***a* depicted in FIG. 7. However, in contrast to the latter, here the attachment device **24***b* is constructed for suspending thereat the wall elements **12** and additionally serves to drape an outside building wall in contrast to forwardly placing same, as such is possible with the attachment device **24***a* of FIG. 7. Here again, attachment device **24***b* possesses a support or holder member **32** which is secured by means of an anchoring portion **30** to the floor ceiling **10**. The holder portion **32** is equipped with vertical downwardly directed substantially L-shaped shoulders **56** upon the horizontal legs **58** of which there are suspended the lower wall element **12** through the agency of roller body members **34**. Furthermore, the holder member **32** is equipped with vertically upwardly directed shoulders **60** at which there are supported, against forces acting transverse to the wall surface, the upper wall element **12** through the agency of elastic spacer member **36**.

FIG. 9 schematically illustrates in sectional view the outside building wall, and specifically the region at which there abut the four wall elements **12** of the inner wall layer portion **14** as well as the four elements **20***c* and **20***d* of the outer wall layer portion. In order to provide clarity in illustration the individual components have been shown in exploded view in a direction away from the building-support construction. The wall elements **12** of the inner wall layer portion are mounted or retained at the attachment or securing devices **24**. In so doing, the wall elements **12** can either be erected or suspended at such attachment devices. Accordingly, these attachment devices are either constructed similar to the attachment devices **24***a* of FIG. 7 or the attachment devices **24***b* of FIG. 8. The wall elements **12** of the inner wall layer portion **14** can additionally be equipped with attachment devices **24** at their vertical joints, which further serve to absorb forces acting transverse to the wall, such as for instance wind pressure or wind suction. Thus the wall elements **12** are supported at these attachment devices **24** by means of elastic spacer members corresponding to the spacer members **36** of the attachment devices **24***a* and **24***b*.

Continuing, it will be recognized that the attachment device **24** of the exemplary embodiment of FIG. 9 is secured, for instance to a vertical support **62** of the building-support construction, through the agency of the anchoring portion **30**. The lateral attachment device **24** is not absolutely necessary. In most instances the lower and the upper attachment devices **24** for supporting the wall elements **12** are sufficient. The attachment of the outer wall layer portion **16** and the insulation membrane or skin **18** to the inner wall layer portion **14** will be described more specifically hereinafter. At this point it is mentioned that the outer wall layer portion **16** is constructed analogous to the wall layer portion illustrated in FIG. 7 and possesses a window element **20***c* and insulation element **20***d*. In order to cover the joints between the elements of the outer wall layer portion there are once again provided displaceable cover members.

The characteristic feature for the multi-layered outside building wall of the previously described type is that the wall elements **12** of the inner wall layer portion do not contact one another directly. The same is also preferably true for the elements of the outer wall layer portion **16**. The separation joints between the wall elements of the wall layer portions can be locally filled or continuously filled with a highly elastic or plastic material. It is also possible to bridge or close the joints with elastic, or as shown in the illustrated example, with rigid displaceable covering ledges **54**.

FIGS. 10–15 illustrate different types of connections of the outer wall layer portion **16** with the inner wall layer portion **14** while enclosing the insulating skin or membrane **18** therebetwen.

Describing now more specifically FIG. 10, it will be recognized that for the purpose of retaining together the entire layer aggregation or complex of the outside build-

ing wall there is advantageously provided a suitable bolt member **64** which is piercingly inserted through a corresponding bore of the cover member **54**, and which further penetrates the insulation skin **18** and is disposed between the frame members **19** of neighboring wall elements **12**. The bolt member **64** which is constructed as a threaded bolt, for instance, is threaded into a flat metal portion **66** bearing from the inside against the legs of the frame members **19** of the wall elements **12**. In order to space the cover member **54** and the flat metal portion **66** there is arranged therebetween a spacer sleeve member **68** which is inserted through a suitable opening provided at the insulation layer **18**. Instead of using the spacer sleeve **68**, it is possible to equip the threaded bolt member **64** itself with a suitable shoulder or projection which, after tightening of the threaded bolt member **64**, fixedly positions at a certain distance the flat metal portion **66**. By virtue of this arrangement there is insured that the insulation layer **18** is freely movable between the inner and outer wall layer portions **14** and **16**, respectively. This type of spacer bolt member **64**, as a general rule, does not absorb any vertical forces, rather serves only for preventing the raising of the outer wall layer portion **16** from the inner wall layer portion **14**.

Now FIG. 11 shows the arrangement of the bolt member **64** as well as a further spacer bolt member **70** which, in the first instance, serves to absorb the vertical loads of the outer wall layer portions **16** prevailing from its own weight. Through the provision of suitable devices, such as for instance adjustment screws **72**, it is possible to undertake an adjustment of the outer wall layer portion **16** with respect to the inner wall layer portion **14**. The connection between the outer and inner wall layer portions can also be undertaken in such a manner that at the regions where there should prevail a sealing pressure between the outer and innner wall layer portions there is possible a clamping together of both wall layer portions.

FIGS. 12–14 depict different possibilities for sealing the bolt member **64** at the insulation layer **18**. The requirements placed upon the bolt member **64** are likewise applicable in analogous manner for the spacer bolt members **70**. According to the embodiment shown in FIG. 12 the insulation skin **18** possesses a suitable opening **74** having the diameter *c* which is considerably smaller than the diameter *d* of the bolt member **64**. The material of the insulation skin member **18**, because of its existing elasticity, enables a faultless spreading of the small opening **74** to the bolt cross-section *d*. The thus provided enclosing contact pressure seals the penetration point of the bolt members **64** through the insulation skin **18** against the penetration of moisture without requiring any additional measures.

FIG. 13 depicts, similar to FIG. 12, a penetration point which, in this instance, however, is constructed in such a way that the insulation skin remains freely movable. The throughpassage opening **74***a* provided at the insulation skin or membrane **18** is larger by the dimension *e* than the bolt diameter *d*. The insulation skin or membrane **18** is equipped at the region of the throughpassage opening of the bolt member **64***a*, preferably in vertical direction, and over the entire length of the layer with a continuous rib-like reenforcement **76**. The throughpassage opening for the bolt member **64***a* is arranged at this reenforcement **76**. A channel **78** extends to both sides of the throughpassage opening, this channel being sealed towards the throughpassage opening **74***a* by means of the sealing lips **80**. Between these sealing lips **80** the bolt member **64***a* is equipped with a disc-like widened portion **82** extending into the channel **78** and directed substantially perpendicular to the lengthwise axis of the bolt member **64***a*. By virtue of this construction of the throughpassage location of the bolt member **64***a* through the insulation skin or membrane **18** a certain freedom of movement is therefore provided. On the other hand, the cooperation of the disc-like widened portion **82** of the bolt member **64***a* and the sealing lips **80** of the channel **78** insure for a sealing of one side of the insulation skin with respect to the other.

FIG. 14 illustrates a further variant of a throughpassage location of the bolt member **64** through the insulation skin or membrane **18**. In this embodiment the insulation skin **18** is equipped with a hose-like reenforcement **84** at the region of the throughpassage location. This hose-like reenforcement **84** advantageously extends in vertical direction over the entire length of the insulation skin **18**. Consequently, this hose-like reenforcement **84** can simultaneously be employed for the vertical stabilization of the insulation skin or membrane. The bolt member **64** itself is guided through the hose-like reenforcement **84** of the insulation skin **18**, so that there is provided a labyrinth-like seal between this bolt member **64** and such insulation skin.

FIG. 15 depicts a further embodiment of inventive apparatus **86** for connecting the outer wall layer portion **16** with the inner wall layer portion **14**. To this end, an angle piece **88** is mounted to the frame member **19** of a band element **12** of the inner wall layer portion **14**. The free leg portion of the angle piece **88** is provided with an elongate hole or opening **90** through which there is guided a connection element **92** equipped with a barb or hook **94**. This barb or hook **94** is directed towards the outer wall layer portion **16**, penetrates through the insulation skin or membrane **18** and engages with an elongate hole or opening **96** provided at the frame member **22** of the element **20** of the outer wall layer portion **16**. By means of a suitable wedge **98**, engaging with an appropriate elongate hole or opening **100** of the connection member **92**, it is possible to draw the barb or hook **94** towards the angle piece **88**, and therefore, to clamp the element **20** of the outer wall layer portion **16** to the inner wall layer portion **14**. This wedge **98** can furthermore be constructed such that it is resilient, so that a uniform contact of both wall layer portions is achieved.

FIGS. 16 and 17 depict a further embodiment of multiple-layered outside building wall in analogous illustration to the embodiment of FIGS. 4 and 6. In the embodiment of FIGS. 16 and 17 the inner wall layer portion **14***a* is not continuous, rather subdivided or broken by components of the support construction of the building. The individual wall elements **12***c* rest upon portions of the support construction of the building. In the embodiment of FIG. 16 the wall elements **12***c* are supported at the lower end to the floor ceiling and at the upper end are secured to a heavy beam or girder **102**.

On the other hand, in the embodiment of FIG. 17 the support construction is equipped with a marginal support member **104** merging with the floor ceiling **10**. The wall elements **12***c*, in this case, are secured to the marginal support **104** and can extend up to the lower side of the upper marginal support. However, it is also possible to support the wall elements **12***c*, at their upper ends laterally at a beam or girder **102**. In the embodiment shown in FIG. 17 not as high requirements are placed upon the accuracy or exactness of the support construction, since the wall element has room for compensating for inaccuracies up to the underside of the marginal support **104**.

The wall elements **12** can be either directly secured by means of their frame members **19** to the construction portion of the building support construction or can be thusly secured by further using a contact rail **106**, as such will be more fully explained hereinafter. This embodiment not only provides the advantage that the attachment devices of the previously mentioned type can be dispensed with, rather it is also possible to secure at the building location the contact rails in such a way that the wall elements only have to be additionally inserted. Furthermore, the contact rails can be sealingly pressed against the relevant portion of the support construction, and therefore, provide a tight closure between the contact rail and the portion of the support construction. The

omission of the contact rail **106**, that is to say, when directly mounting the frame **19** of the wall element **12** upon wedge members of the support construction simplifies the construction of the support construction, yet, on the other hand, however, requires a larger expenditure during the mounting of the wall elements **12**. It is to be decided from case to case which of both embodiments is more advantageous for the particular application under consideration.

The remaining components of the multiple-layered outside building wall, that is to say, the insulation skin or layer **18** and the outer wall layer portion **16** can be constructed in the manner already heretofore described.

FIG. 18 illustrates in a manner similar to the illustration of the embodiment of FIG. 9, further details of the outer wall of the building of FIG. 17. The wall element **12***c* of the inner wall layer portion **14***a* bears upon the contact rail member **106** via an attachment device **24***c*, this contact rail member **106**, in turn, being secured via ledges **108** to the marginal support means **104**. These ledges **108** can be formed of elastic material in order, on the one hand, to compensate for unevenness and, on the other hand, for sealing the joints between the contact rail **106** and the marginal support means **104**. The attachment device **24***c* is supported against the contact rail **106** through the agency of two angle members **110**, of which one is secured to the contact rail **106** and the other to the support member **32** of the attachment device **24***c*. The wall element **12** bears upon a roller body member **34***a*, the lengthwise axis of which extends parallel to such wall element. Both of the outer leg members of the frame **19** of the wall element **12***c* are supported via elastic spacer members **36** at the vertical shoulders or projections **38** of the support or holder member **32**. This construction of the attachment device **24***c* renders it possible to displace, in the direction of the building support construction, the wall element **12***c* and therefore the multiple-layerd outside building wall. The roller body member **34***a* can be rotated through the angle α. This attachment device renders possible the transmission of horizontal as well as vertical forces from the wall element via the contact rails to the building structure. In so doing, it also particularly enables the outside building wall to perform expansion movements. In contrast to the attachment device **24***c* of FIG. 18, other more simplified connections between the frame **19** of the wall element **12***c* and the contact rail are possible. The remaining construction of the multiple-layered outside building wall is analogous to the previously described exemplary embodiments and therefore need not be repeated at this point.

FIG. 19 illustrates a further embodiment of a multiple-layered outside building wall in which the wall elements **12***c* are supported at the floor ceiling **10** and secured to a beam or girder **102**. Furthermore, in this embodiment of invention there is illustrated how the inner wall layer portion **14***a* is interrupted in vertical direction by supporting brackets **112** of the building support construction. Furthermore, attachment of the wall elements **12***c* to the vertical supporting brackets **112** can be achieved through the agency of contact rails **106**.

In this embodiment the inner wall layer portion **14***a* is placed between the construction elements, that is to say, the beam or girder **102** and the supporting bracket **112**, of the building support construction.

FIG. 19 depicts still a further especially advantageous embodiment of multiple-layer outside building wall, wherein a cantilever support **114** extends laterally from the support construction of the building towards the outside, that is to say, in the present case extends from the girder or beam **102** towards the outside, and penetrates through the insulation skin or membrane **18** as well as the outer wall layer portion **16**. Such cantilever supports **114** can be provided at different locations of the outside of the building and serve to accommodate different structural elements situated externally of the outside building wall. In the instant embodiment covering plate members **116** are secured to the cantilever support **114**. Furthermore, balconies can be arranged in this manner at buildings equipped with multiple-layered outside building walls of the aforementioned type. Furthermore, concrete embedded members, not shown in the drawing, can extend out of the throughpassage point at the cantilever beam **114**, which then can be welded with the insulation skin or membrane **18**. As a result, the penetration location of the cantilever beam **114** at the insulation skin **18** can be completely sealed. By utilizing this construction principle it is also possible to arrange the supporting elements of the building support construction externally of the facade of the building. In this instance the cantilever support would be a support member which penetrates through the insulation skin **18** and the outer wall layer portion and leads up to the carrier support.

Moreover, the multiple-layered outside building wall can also be used at such structures which possess a facade projection or the like. In this case, the insulation skin **18** and the outer wall layer portions **16** would be guided about such facade projection.

FIG. 20 illustrates the arrangement of heating tubes or pipes **118** and heating plate members **120** in the wall element **12***c* of the inner wall layer portion **14**. The heating plates **120** are situated at the region of the window elements **20***c* of the outer wall layer portion **16**. The heating tubes or pipes **118**, on the other hand, are arranged in the hollow space or compartment formed by the frame members **19** and the contact rail **106**. The warm air flows upwardly through an opening **122** at the region of the window element **20***c* and, furthermore, flows through a further opening **124** at the upper frame portion until it escapes out of the wall element. The remaining structure of this embodiment corresponds to the already heretofore described exemplary embodiments.

FIG. 21 illustrates a further embodiment of a heating device for the inner wall layer portion **14** of the multiple-layered outside building wall. There are illustrated the vertical components of the frame member **19** of two neighboring wall elements **12***c*. In the illustrated exemplary embodiment, the frame members which, in cross section, are of substantially U-shaped configuration, are inverted with respect to the previously illustrated exemplary embodiments, that is to say, the open U-region is directed towards the inner space of the wall element **12***c*. This arrangement is especially advantageous since here the heating pipes **118** can be used as radiation pipes which transmit their heat over the entire height of the windows to the window region. It is also possible to have the tubes conduct hot air and to blow such laterally into the interior of the wall element **12***c*.

If the wall element of the inner wall layer portion is, for instance, equipped with a window railing or a parapet, then it is especially advantageous if the heating pipes are situated at the region of such railing and if such possesses upwardly directed slot means or the like through which the hot air can flow to the window region of a window element of the outer wall layer portion. If desired, it is advantageous to provide, instead of only a single heating tube operated with warm water, additionally an electrical heating plate at the wall element. The construction of a good and effective heating unit in the outside building wall is of significance since the relative moisture content of the air is continuously increased for a number of reasons by the climatization in the building and therefore difficult condensation problems occur at the region of the windows. Since the coefficient of heat transmission is subjected to technological limits by the arrangement of the window panes, which do not prevent formation of condensation, it is necessary to resort for additional help upon a further heating unit. It is also necessary to withdraw any condensation which has formed out of the multi-layered outer building wall. To this end there can be provided suitable collecting troughs at appropriate locations.

The wall element of the inner wall layer portion can be constructed in such a fashion that it serves as a heat storage means. To this end it is advantageous to fill the frame means **19** with a material possessing a large heat storage capacity. As a result, in connection with an electrical heating unit it is possible to provide a heating system wherein, for instance, by using inexpensive evening current the wall element can be heated during the nighttime and during the daytime its stored heat can be delivered to the space or room.

Furthermore, the outer wall layer portion can be constructed in such a fashion that externally situated, lowerable sun louvers or shutters can be mounted which serve as protection against the sun.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be oherwise variously embodied and practiced within the scope of the following claims. Accordingly, what is claimed is:

1. In combination with a building or the like a multilayered outside wall construction for said building, comprising an outer wall layer portion, an inner wall layer portion, a plastic barrier membrane disposed between said outer and inner wall layer portions, said barrier membrane being formed of an elastically elongatable, water-impermeable tear-resistant material possessing thermally and acoustically insulating properties, said membrane being covered at least by means of said outer wall layer portion and said inner wall layer portion but yet free to move independently of said inner and outer wall layers, said barrier membrane possessing substantially fewer interruptions defining separation joints relative to said inner and outer wall layer portions, said inner wall layer portion being composed of a plurality of laterally arranged substantially quadrangular wall elements which are freely spaced from one another, the spaces between said adjacent spaced wall elements of said inner wall layer portion defining respective compartments which are hollow throughout the total thickness of the inner wall layer portion, said hollow compartments remaining unfilled and at most receiving attachment devices for securing the wall construction.

2. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein said wall elements are horizontally spaced from one another.

3. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein said wall elements are vertically spaced from one another.

4. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein said insulation skin is devoid of separation joints to define a continuous insulation skin.

5. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein said wall elements are horizontally and vertically spaced.

6. A multi-layered outside wall construction for a building or the like as defined in claim **5**, wherein at least the largest part of the horizontal spacing of the wall elements and at least the largest part of the vertical spacing of said wall elements of said inner wall layer portion are substantially equal to one another.

7. A multi-layered outside wall construction for a building or the like as defined in claim **1**, further including means for mounting said wall elements so as to be laterally movable with respect to one another.

8. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein the building incorporates a support construction, and means for mounting said outside wall construction completely in front of said support construction.

9. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein the building possesses a support construction formed of structural components, said inner wall layer portion being arranged between said structural components of said building support construction.

10. A multi-layered outside wall construction for a building or the like as defined in claim **1**, further including attachment means for suspending said wall elements of said inner wall layer portion.

11. A multi-layered outside wall construction for a building or the like as defined in claim **10**, wherein said wall elements of said inner wall layer portion are suspended at said attachment means through the agency of roller body means.

12. A multi-layered outside wall construction for a building or the like as defined in claim **9**, further including roller body means for supporting said wall elements of said inner wall layer portion.

13. A multi-layered outside wall construction for a building or the like as defined in claim **12**, further including contact rail means arranged at said structural components of said building support construction and serving to support the wall elements arranged between said structural components of said building support construction.

14. A multi-layered outside wall construction for a building or the like as defined in claim **1**, further including elastic spacer means for supporting said wall elements against forces acting transverse to the outside wall construction of the building.

15. A multi-layered outside wall construction for a building or the like as defined in claim **1**, further including means for interconnecting said inner wall layer portion with said outer wall layer portion, said connecting means comprising bolt means penetrating through said insulation skin, and spacer means for retaining both of said wall layer portions at such a distance from one another that said insulation skin is movably retained therebetween.

16. A multi-layered outside wall construction for a building or the like as defined in claim **1**, further including means for interconnecting said outer wall layer portion, insulation skin and inner wall layer portion, a counter support cooperating with said inner wall layer portion, said outer wall layer portion being provided with an opening, said connecting means comprising a connecting element having a hooked member engaging with said opening of said outer wall layer portion, and wedge means cooperating with said connecting element for biasing said connecting element against said counter support.

17. A multi-layered outside wall construction for a building or the like as defined in claim **1**, wherein each of said wall elements of said inner wall layer portion comprises frame means formed of a profiled material.

18. A multi-layered outside wall construction for a building or the like, as defined in claim **17**, wherein said profiled material possesses a substantially U-shaped cross section with the open side of said profile material being disposed along the end face of the associated wall element.

19. A multi-layered outside wall construction for a building or the like as defined in claim **17**, further including heating means provided for said wall elements of said inner wall layer portion.

20. A multi-layered outside wall construction for a building or the like as defined in claim **19**, wherein said frame means of each wall element comprises a horizontal portion, heating means arranged at said horizontal portion of said frame means, each of said wall elements being provided with an opening and said frame means being provided with an opening, whereby warm air can move through said opening of each said wall element into the interior thereof and can escape through said opening of said frame means.

21. A multi-layered outside wall construction for a building or the like as defined in claim **19**, wherein said

frame means of each wall element comprises a vertical side portion, vertical heating means arranged at said vertical side portion and which laterally deliver heat to the interior of said wall element.

22. A multi-layered outside wall construction for a building or the like as defined in claim **21**, wherein the building possesses a building support construction having components arranged between said wall elements, a cantilever support arranged at least at one component of said building support construction, said cantilever support penetrating through said insulation skin and said outer wall layer portion and serving for the attachment of structural components situated externally of the outside wall construction of the building.

23. A multi-layered outside wall construction for a building or the like as defined in claim **22**, wherein said cantilever support is provided with insulation skin components coupled with said insulation skin arranged between said inner wall layer portion and said outer wall layer portion.

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