Jan. 7, 1941. P. M. JULLIEN 2,227,452

CONSTRUCTION UNIT

Filed March 30, 1937 3 Sheets-Sheet 1

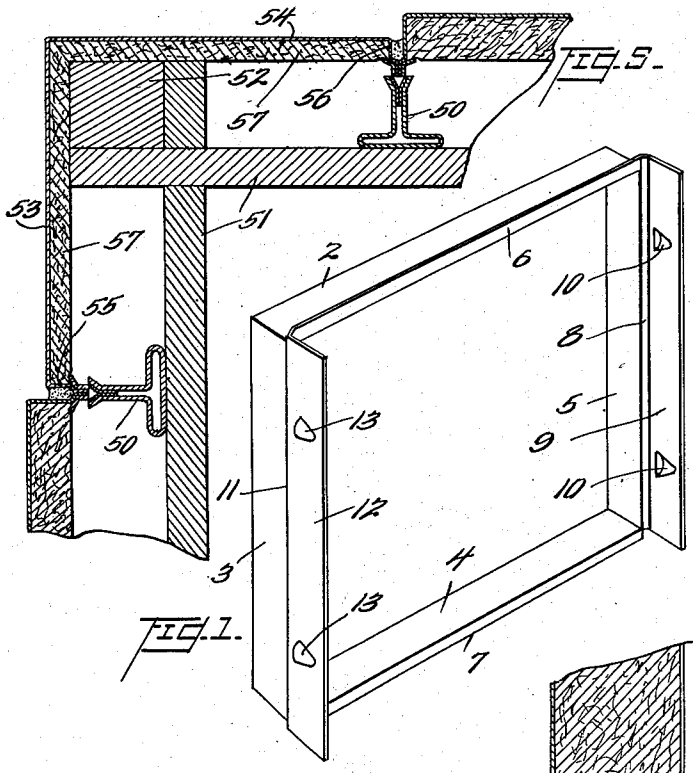


FIG. 1.

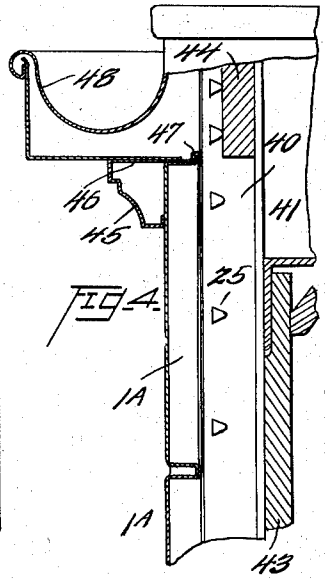


FIG. 4.

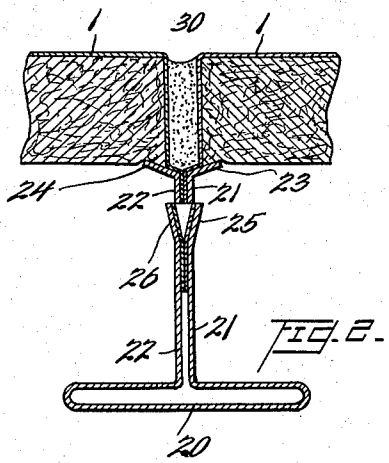


FIG. 2.

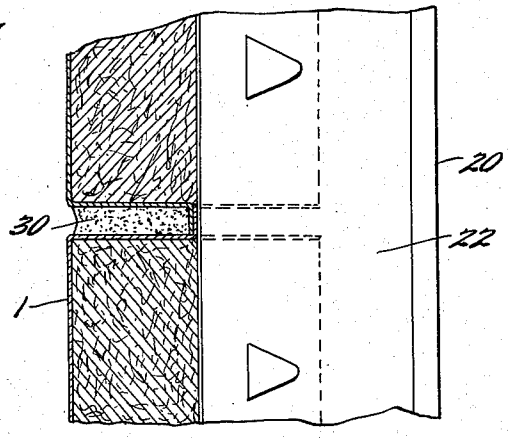


FIG. 3.

Inventor

Philip M. Jullien,

By Raymond J Norton

Attorney

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CONSTRUCTION UNIT

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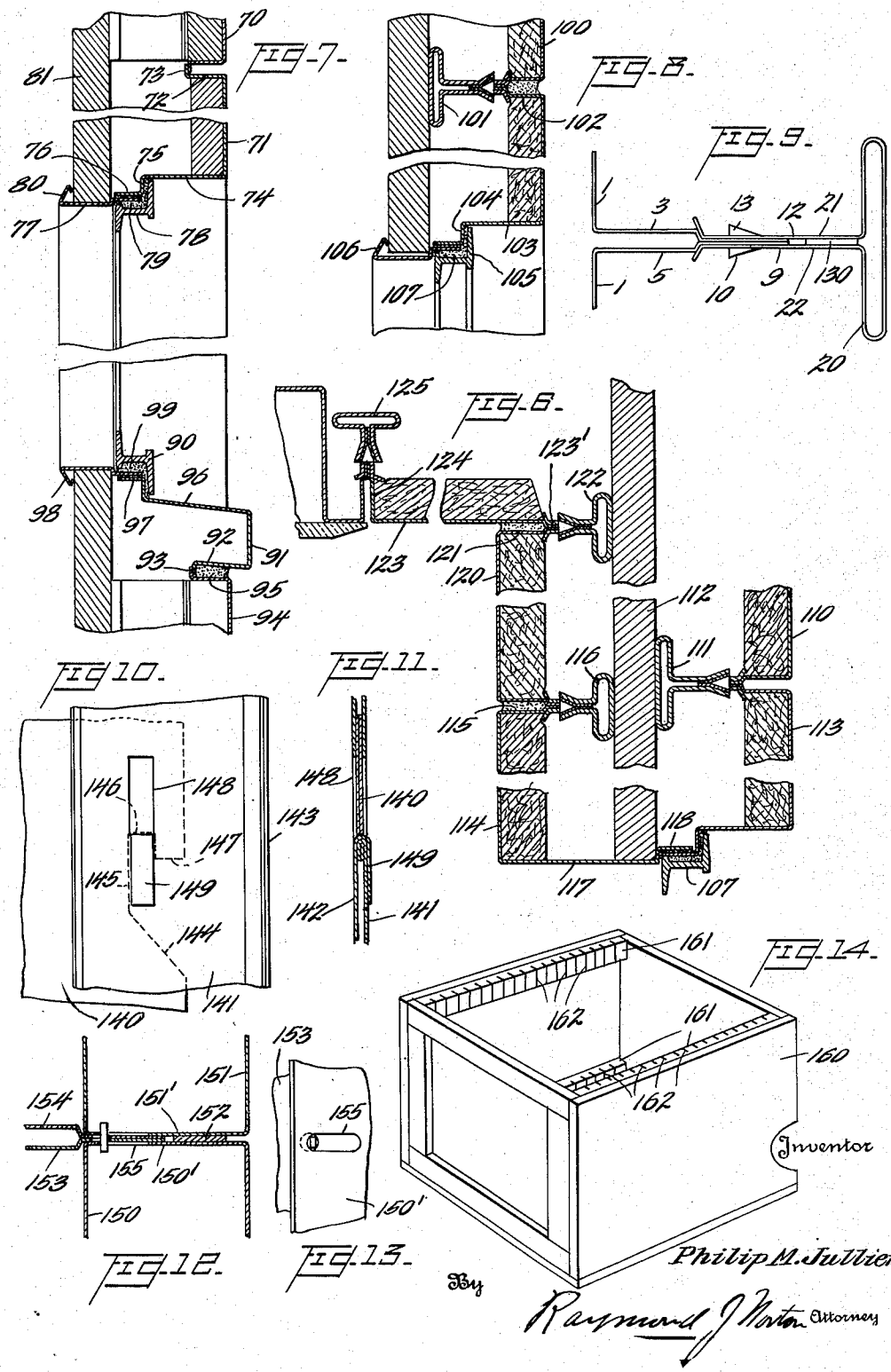

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CONSTRUCTION UNIT

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FIG. 15.

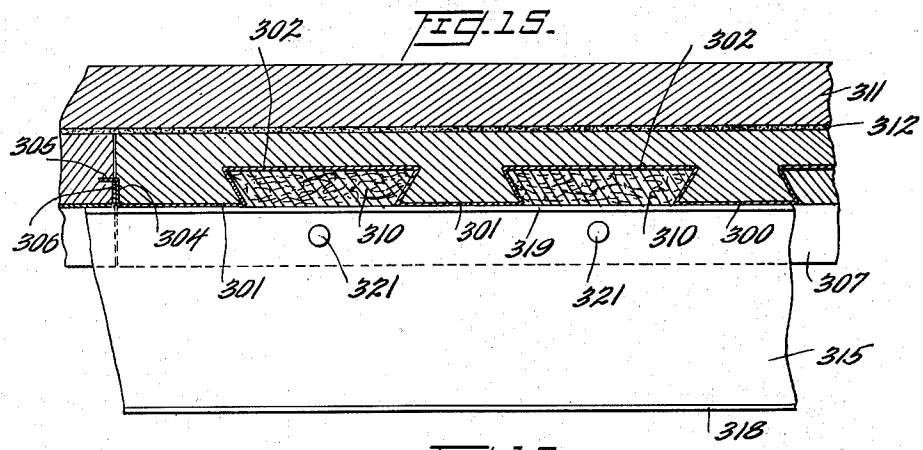
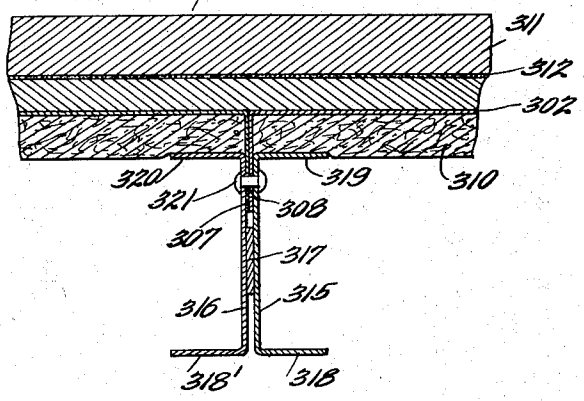



FIG. 16.



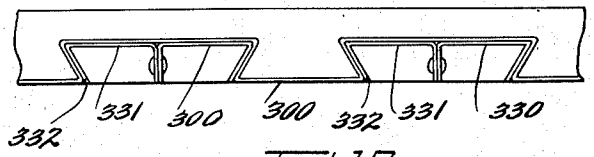




FIG. 17.

Inventor

Philip M. Jullien,

By Raymond J. Norton

Attorney

Patented Jan. 7, 1941

2,227,452

# UNITED STATES PATENT OFFICE

2,227,452

## CONSTRUCTION UNIT

Philip M. Jullien, Washington, D. C.

Application March 30, 1937, Serial No. 133,870

5 Claims. (Cl. 189—85)

This invention relates to the production of structures or buildings, more particularly to novel types of construction units.

In recent years there has been a marked development in that type of building construction known as "prefabrication". This development is based essentially on the concept of standardization of the sections of a building, in relatively large units; the manufacture of these under economical conditions of mass production, and the transportation and assemblage with minimal expenditure of labor.

Marked advances have been made in this type of structure. Such systems, however, are subjected to certain inherent disadvantages. The economy of this plan largely depends on the utilization of relatively large and standard units or elements of construction. A natural incident of the use of such units, therefore, is a marked limitation in the field or range of design of the house or other structure which may be constructed of them. This system for the most part is developed on the idea of cheap construction of what, for the sake of a term, may be called the shell of the building; that is to say, the prior suggested methods present no real advances either in improved design or construction of interiors. This particular phase of building construction remains largely as it has for years, depending now, as then, on the use of old materials, i. e. plasters, wood finishes and the like, prepared to specification substantially individual to each building, and conformed to such specification largely at the site and by local labor.

The present improved system of construction has been devised not only to obviate the disadvantages inhering in such earlier types of prefabrication structures, but also to insure additional and positive advantages over such older types. As will be seen more fully hereinafter, the present system presents a wide and extensive range in technical design and esthetic effects. It is, as will be seen, amenable equally for utilization in new structures and for the redesigning or remodeling of old.

The novel building units herein contemplated are so designed as to be employable with substantially standard structural members. With suitable modifications of the surface finish the units may be utilized as exterior as well as interior surfaces and in this use such units similarly present a very wide permissive range in design and effect.

The invention also contemplates the production of special types of floor and/or ceiling and roof members which, in common with the main units, are adapted to be associated with standardized structural members to be readily locked in place and permanently assembled in the structure.

An object of the present invention is to provide a novel type of building structure.

Another object is to devise a new method of erecting building structures.

A further object is to devise a special building unit adapted to receive a wide variety of surface finishes and to be attached directly to suitable structural elements to immediately form a finished interior and/or exterior surface.

Yet another object is to provide a novel unit of the class described of standardized sizes and surface and so designed as readily to be fabricated, transported and assembled.

A further object is to provide an improved type of floor and/or ceiling and roof unit.

With these and other equally and important objects in view, the invention comprehends the concept of prefabricating special metallic building units, preferably of metal construction, and having integral locking means thereon, which units are adapted to be engaged with and locked in suitably designed studs, struts, beams, rafters and other structural building members to thus immediately provide a continuous and ultimate surface. As will be seen, the unit is so designed that it may be given any desired surface finish, at the point of production, so as to insure the widest latitude in surface effects, coupled with the optimum facility of installation.

In order to clarify the principles of the invention, typical physical embodiments are shown in the accompanying drawings. It is clearly to be understood that these embodiments are merely illustrative of the fundamental concepts involved and are not the exclusive methods by which such concepts may be effectuated but, on the contrary, are given as illustrative of the wide range of structural modifications of which the fundamental concept is susceptible.

In the drawings,

Figure 1 is a perspective view of a typical building unit produced according to the present invention.

Fig. 2 is a horizontal section of the structure of Fig. 1, illustrating the method of locking the units to a stress taking member, such as a stud.

Fig. 3 is a vertical section taken on line 3—3 of Fig. 2.

Fig. 4 is a diagrammatic illustration of the ele-

mental units utilized on the exterior at a roof cornice.

Fig. 5 illustrates the association of the elemental units on an exterior corner construction.

Fig. 6 is a horizontal section of a bath room wall illustrating the association of the improved units with standard steel window construction.

Fig. 7 is a detail of a window head and window sill in which the improved units are assembled.

Fig. 8 is a detail of the corresponding window jam.

Fig. 9 is a section illustrating one improved method of locking the improved units to a structural member, such as a stud.

Fig. 10 is an elevation of another method of locking the units to structural members.

Fig. 11 is a vertical section taken through Fig. 10.

Fig. 12 is a detail illustrating yet another method of locking the metal surface units to backing studs.

Fig. 13 is a detail illustrating the type of locking means employed in the structure shown in Fig. 12.

Fig. 14 is a diagrammatic illustration of a shipping case in which the units of the present invention may be packed and shipped.

Fig. 15 is a view of the novel type of floor construction.

Fig. 16 is a sectional detail illustrating a method of supporting the floor structure of Fig. 15.

Fig. 17 is a detail section of a modified form of the structure shown in Fig. 15, illustrating the employment of metal inserts for increasing the strength of the structure.

As indicated, a salient feature of the present method of construction is the utilization of a novel type of what, for the sake of a term, may be called the elemental unit. As shown in Fig. 1, in its simplest form this comprises a specially formed metal pan. The pan, as will be seen more fully hereinafter, may be stamped or otherwise shaped from a blank of any suitable metal or alloy to substantially the form shown in Fig. 1. The unit of Fig. 1 comprises a flat surface or face 1 and the perimetal or marginal flanges 2, 3, 4 and 5. The top flange 2 is bent to form an angularly projecting lip 6, and the opposite or bottom flange 4 is similarly provided with the depending lip 7. As will be noted in Fig. 2, the upper lateral flange 2 is slightly deeper than the corresponding lower flange 4 so that when the parts are in the assembled position (as shown in Fig. 3) the terminal lip (or edge 7) of flange 4 lies within and closely abuts the lip 6.

The pan may be made up in a series of standardized units so designed with respect to typical sized rooms and the like as to insure conformity to the ultimate desired dimension. The pan similarly may be made up in different shapes, for example in the square shape shown in Fig. 1 or in a more rectilinear form.

The lateral flange 5 is, as shown in Fig. 1, offset at 8 and is then bent, in substantial parallelism with the flange 5, to form the terminal flange 9. The flange 9 is punched to provide the projecting lugs 10 which, as will be seen more fully hereinafter, serve to lock the elements to a structural member.

Flange 3 is formed similarly to flange 5. As shown, this is provided with the offset portion 11 and this is angularly bent to produce the terminal flange 12 lying substantially parallel to flange 3 but offset therefrom. Flange 12, like flange 9, is provided with the punched out locking lugs 13.

It will be seen that the unit thus described comprises in effect a pan or dish having an area, bounded by flanges 2, 3, 4 and 5, which is available for reception of additional material. In this space there may be inserted suitable solid insulating material. As shown in Fig. 2, the insulating material is adapted to extend above the upper and lower lips of the pan member, thereby providing a seat against which the outer stud surface is forced by pressure until the pan locks itself in place. This results in a cushion seat or resilient lock and serves to eliminate squeaks or other noises in case of relative movement of the pan. If desired, during manufacture, after the pan has been formed, this space may be filled with insulating material in the plastic form, that is to say the pan may be filled with insulation material, which latter is allowed to set in situ. By inserting or setting insulating material within the confines of the lateral flanges, it will be appreciated that the units thus produced comprises a structural member which is already self-insulating. The insulation material may be of any desired type designed to diminish the transmission not only of heat but of sound.

As indicated, a series of units or pans 1 are specially formed so as to be adapted to be assembled and locked in place upon stress-taking or structural members. As shown, for example in Figs. 2 and 3, the structural or stress-taking member may comprise a web shaped strut 20. In the typical embodiment this may be formed from a single blank of suitable gauge, deep draw steel and is formed as shown to provide the lateral spaced web portions 21 and 22. At the upper end the webs 21 and 22 are preferably formed with laterally extending marginal lips 23 and 24. These lips preferably are of different angularity and length from the offset flanges 8 and 11 respectively of the pans so that these flanges of the pans are spaced from and abut the corresponding contiguous flanges 23 and 24 of the strut. The flanges 21 and 22 of the strut are adapted, as shown in Fig. 2, to firmly abut the resilient insulating material. These flanges are provided with the laterally displaced portions 25 and 26. It will be understood that the material utilized for the strut 20 may be of sufficient resiliency so that the web flanges 21 and 22 may, upon the application of force, be displaced laterally against the inherent spring tension of the material although for most purposes resilient locking may be secured. As will be seen from Fig. 2, when the elements are assembled the flanges 9 and 12 of the pans are inserted in the space between the webs 21 and 22 of the pan and are forced downwardly into the web until the lugs 10 and 13 snap and lock into the webs at the sections 25 and 26.

It will be understood of course that the strut 20 may comprise a separate member which is adapted to be fastened, as by bolts, nails and the like, to wood beams or may be suitably fastened to the heavier metal structural member. Similarly the strut may be of wood formed with a saw cut or groove along its major length and adapted to receive the flanges of the pans. Such wooden stud may be provided, at predetermined intervals, with metal bands which serve to engage with hooks or cut out portions of the flanges and thus lock the pans in position. Such a groove may be formed on opposite sides of a stud so as to permit mounting of the pans on both sides.

It will be observed from the description thus far, that with a suitable number of studs **20**, suitably positioned, an entire wall surface may be built up by the simple expedient of merely snap-locking the pans into place. When this is done the unit in effect comprises a substantially continuous metallic surface rigidly and resiliently locked to a metallic or wooden stud of substantial strength and rigidity. When the pans have been inserted in place in the manner described, the spaces between the adjacent flanges **2** and **4** may then be filled up with a suitable mastic, as indicated by numeral **30** (Figs. 2 and 3) so as to provide a substantially continuous exposed surface.

It will be appreciated that this type of construction provides a tremendously great potential choice of design and effect. As will be understood by those skilled in the art, the technological as well as the esthetic effects of such improved surface may be greatly varied. For example, in a case of simple construction the pan element **1** may be made up from a deep draw, low carbon steel. At the factory the pan may be stamped out in a rapid and simple manner. The exterior surface or plate **1** may be coated with a suitable porcelain enamel and baked under factory conditions which may be carefully controlled to produce a smooth artistic surface in any desired color. As has been explained, at any desired stage in the production the interior or dish portion of the pan may be filled with a suitable insulating material. Again, for certain purposes it may be desired to produce a pan unit which is initially of the desired ultimate surface. In such circumstance, as for example for use in shower baths and the like, the pan may be constructed of rustless iron or stainless steel. In these circumstances no additional coating or surface finish need be employed. The stainless steel member is itself artistic in appearance and eminently resistant to corrosion.

Again, in lieu of providing a surface finish of a typical enamel almost any other desired surface may be applied to the pan. Thus in lieu of paints, enamel and varnishes, the surface of the pan may be coated with a synthetic resin in the plastic and fusible stage and the coated unit then placed in a suitable mold and treated so as to polymerize the resin and convert it to the insoluble, infusible form. In this circumstance the elemental unit then comprises a structural member, the surface of which in fact is a resin or resinoid. By incorporating suitable pigments in the resin almost any conceivable chromatic value can be imparted to the finished surface. Also, if desired, alternate and/or adjacent pans may be coated with such eminently resisting and enduring resins, which are pigmented in different tones or shades, to thereby artistically modify the resulting chromatic characteristics of the wall.

Again, with respect to modifications in surface finish, it will be understood that the pans or elements **1**, after having been formed, may be immersed in a plating bath and plated with more enduring and artistic metals, such for example as chromium, nickel, cadmium and the like.

In certain circumstances tonal effects in rooms can be secured by the present system which cannot be duplicated with any other structural material and which are comparable to the esthetic effects obtained by draperies, wall papers and the like. As a specific example of this, the metal of the pans may be made up of a suitable aluminum alloy. After fabricating the pans the alloy may be electrolytically treated, in the manner known to those skilled in the art, and dyed in the electrolyte so as to present an exposed metal surface which is in fact a lake. The surface of each pan may be dyed in the one shade or tone or certain pans may be dyed a differential color. Yet again, by the use of the proper resists, designs in differential colors may be dyed on each pan. The potentialities of such a simple, economic, standardized surface for artistic decorations of interior surfaces are thus substantially without limit, or at least are limited only to the extent of the knowledge in the art of the special surface treatments of metals.

It is to be observed further that certain of the elements may be specially formed or designed to subserve additional and advantageous functions in house construction. For example, as can readily be appreciated, certain of the pans may be formed in which the flat surface **1** is cut or punched out, grilled or the like, so as to provide the inlet or outlet duct of an air-conditioning and/or heating system. Since the elemental unit is of metal, by a simple expedient the end portion of the ducts may be soldered, welded, or otherwise fused to the pan so that upon insertion of the pan in the proper location the inlet or outlet portion of the duct system is installed.

It is particularly to be observed, furthermore, that the potentialities of surface finishing, when using the present system, is not limited to continuous metal surfaces, or continuous surface of coatings which may be applied thereto. Thus, when desired, for any particular purpose, the face portion **1** of the pans may be constructed of expanded metal. There then may be applied to the expanded metal, either at the factory or at the site, any suitable plastic, such as typical plasters, cements, stuccos, and the like. With this form of pan any available type of ceramic material may be applied to the unit. By employing the expanded metal, such plastic material is firmly anchored, in the manner well known to those skilled in the art. In all such surface finishes it will be understood that the mastic or filling material **30** may be correspondingly modified, as by proper choice of materials, proper choice of pigments and the like, to secure the desired technical and artistic effect.

It will thus be appreciated that in view of its inherent characteristics the elemental unit of the present system may be rigidly locked to any desired back member, whether such member be a typical wooden stud or framing or any other structure element of whatever type of material. Similarly, in view of the amenability of the unit to receive a surface of a paint, plastic, ceramic, cement and the like, it will be clear that the elemental unit may be employed equally for exterior and interior surfaces.

It is particularly to be observed that in view of the convenient size and ready assemblage of the unit of the present invention, it is peculiarly well suited for utilization in the redesigning and remodeling of existing structures, as for example by resurfacing existing rooms, redesigning existing rooms by additional partitions and the like.

As will be understood by those skilled in the art, with the concept of an elemental unit such as that described in mind, interior and exterior surfaces may be readily and rapidly erected. Fundamentally the installation of the system requires only the utilization of the novel elemental unit or pan and a locking member or stud to which it is attached. It will be appreciated that

the pans themselves may be made up in different dimensions of such a character that the larger area of a wall is constructed with pans of a standard size and the residual area or dimensions completed with pans of a different size and so designed as to complete the whole unit. As will be understood, the pan may thus be made up in several standard sizes, depending upon the use to which it is to be put, that is to say the particular type of structure in which it is to be fastened. As a typical example, pans or elemental units of the character shown in Fig. 1 may be 20" x 20", and a depth (i. e. of the flange 2) of approximately 2 or 2½". The locking webs 8 and 9, as will be appreciated, may be of variable depth and in the typical case may be, for example, 2 or 2½" in depth. It will be understood that in the assemblage the space between adjacent flanges 3 and 5 will of course be governed by the length and angularity of the offset flanges 8 and 11 and that by the proper choice this may be controlled to any desired extent. At this point it will of course be understood that the units of the invention are susceptible of very rapid assemblage. To assemble it is necessary only to install the studs 21 and then to seqentially snap the pans in place. After the pans have been installed the mastic 30 may be rapidly applied by means of a suitable mastic gum. It is also to be noted that the flanges 8 and 11 are of such form as to provide for expansion and contraction, also for minor adjustments, without affecting the face of the pan.

The association or installation of these units in typical forms of house construction will be understood by those skilled in the art. The inherent character of the elemental units renders the assemblage particularly facile, even in sections of construction which are ordinarily regarded as difficult. For example, as shown in Fig. 4, the element units defined herein may be employed for exterior construction. A type of structure such as that shown in Fig. 4 may readily be assembled. For example, suitable locking studs 40 may be attached to rigid members of the structure, such as the roof joist 41, or to any other rigid structure of the building, such as vertical beam 42. The interior surface may be of conventional construction and may comprise, for example, the insulating board 43 or other interior member. The locking stud, as shown, may extend through the cornice block 44 up to and in abutting relationship with a roof block. In this particular type of installation the lower pan 1a may be of the type of construction herein defined. These, as explained, are permanently locked to the stud and the upper pan 1a may be associated in any typical or suitable manner with the metallic cornice fitting or flashing 45. In these circumstances it will be appreciated that the upper flange 46 of this flashing may be formed with a terminal flange 47 adapted to enclose and lock the upper flange 6 of the pan 1a. In these circumstances, therefore, it will be appreciated that the pan 1a, through the intermediacy of its locking lugs, serves the secondary function of locking the flashing section 45 in position. This upper pan 1a is associated, as shown, with a typical gutter and flashing construction indicated generally at 48.

It will thus be seen that the particular conformation of the elemental units render them readily adapted to a special correlation or assemblage with typical building units. In this form of construction where the pans comprise the exterior surface, the flush surface of the pan may be comprised, as noted, of a suitable resistant metal or may be a solid or expanded metal surface 1 on which is permanently formed and adhered a different type of surface, such as cement, artificially endurated plastic stone, and the like.

As shown in Fig. 5, the elemental units herein defined may readily be utilized together with slightly modified assemblages to produce corner constructions. As shown in Fig. 5 the studs 50, of the character described, may be firmly attached to suitable structural members, such as beams, joists and the like. The corner construction herein shown may be of any suitable form and may comprise the angularly disposed beams or joists 51 extending each beyond the other to the wall limit. At the edge the wood blocking 52 may be provided and the projecting portions of the beams or joists may be bolted thereto in the usual manner. In this type of construction a special corner pan may be utilized. This may be made up in much the same manner as the standardized pan already described but in different conformation. As shown, this comprises the angularly disposed faces 53 and 54. The corner pan, like the standard pan, is provided with the side flanges 55 and 56 which are offset to provide a locking lip in precisely the same manner as the standard pans. These locking lips coact with the contiguous locking lips of the standard pan, in the manner shown, to lock into the webs of the stud 50. These corner pans, as will be understood, are provided with upper and lower flanges corresponding to flanges 2 and 4 of the standard pans and each of such flanges are provided with terminal flanges corresponding to lips 6 and 7, whereby the superposed pans may be assembled in juxtaposition so that the contiguous upper and lower flanges are nested in the manner shown in Fig. 3. Such corner pans may, in the manner described, be filled at the factory or at the side with the insulation material 57. The spaces between juxtaposed flanges of adjacent pans, as has been described, are filled with a suitable mastic 60.

It will be understood that, operating on the same principle, other specially shaped elemental units of the type of the corner pan may be provided to complete a joint or other juncture between two angularly disposed surfaces, whether these be exterior or interior surfaces.

It is to be observed that the present type of elemental unit structure readily lends itself to association with typical standard framing construction, such as window and door frames. An example of such an association is shown on the window construction of Fig. 7. As shown in the upper part of Fig. 7, pans 70, of the type described, may be associated with the window head by the relatively simple expedient of utilizing a specially conformed metal unit 70. Such unit may comprise a metallic plate provided with the end flange 72 terminating in the lip 73. The flange 72 is of suitable depth so that the lip 73 encloses the contiguous lip of the standard pan 70. The lower section of the metal unit may be expanded inwardly in the relatively deep flange 74 which is offset at 75, and then continued as the web 76 which is substantially parallel to the flange 74. In this particular construction it will be understood that the pans 70 form the exterior wall surface.

In the manner well known to those skilled in the art, the metallic flashing member 77 may be

conformed to fit between the flange 76 and the metal window beam 78. In the approved manner a suitable plastic material 79 may be interposed between the beam 78 and the flashing 77. The flashing 77 may have an inturned molding flange 80 adapted for abutment against the interior wall 81 in the known manner. The lower portion of the window, i. e. the window sill, is generally similarly conformed. In these circumstances the sill or beam 90 is associated, as shown, with a sill framing 91. This framing is provided with the lateral flange 92 which terminates in the marginal lip 93. This, as shown, abuts the marginal lip of the standard pan 94. The space between the adjacent flanges 92 and 95 may be filled with mastic in the manner described. The window sill member extends laterally as the flange 96 and is then bent to form the L-shaped terminal 97. This abuts the sill flashing 98 in the manner shown in Fig. 7. Interposed between the flashing 98 and the beam 90 is any suitable plastic filling material 99. In this type of window structure, therefore, it will be appreciated that the particular terminal conformation of the pans, i. e. the flanges 2 and 4 and their associated lips 6 and 7 respectively, present a simple method of associating such pans with standardized metallic framing members.

As shown in Fig. 8, the window jam construction may be of a similar type. The pans 100 constituting the exterior wall are locked, in the manner described, to the studs 101. The pan adjacent the jam is, as shown, of special conformation. Its terminal flange, indicated generally at 102, is substantially identical with that of the standard pan. The face plate of the pan may be of the size desired and the other flange 103 is extended deeply to the desired depth and is, as shown, offset laterally at 104 to fit over the window jam member 105. Associated with the special window pan and window jam and interposed therebetween is a typical flashing member 106. The setting of this type of structure is made in a suitable plastic 107 in the typical manner.

It will thus be seen that an exterior or interior wall unit may be constructed and that this may be built up about a standard window, or door, member by the relatively simple expedient of providing specially conformed pans. These may be standardized as to size and shape so that but relatively few pan units are necessary for the complete structure. It will be understood that these special pans, i. e. the corner pans and the window pans, may be made up at the factory and given the same surface treatment as the simpler wall unit pans.

It will be observed then, as has been described, that the elemental units of the present invention are readily assembled to form an exterior wall not only on the flat surfaces of the wall but on the more complicated angular constructions. The units are amenable for employment with similar facility on interior corner wall construction. An example of such a construction is shown in Fig. 6. To further show the special adaptability of these units to interior and exterior wall constructions, a detail of an external and internal pan assemblage is shown in this figure. The exterior pans 110 may be attached, in the manner already described, to a series of studs 111, the latter being firmly secured to any suitable structural member, such as the joist 112. Associated with the stud 111 is a special window pan 113 of the type shown in Fig. 8. This is associated with the window jam 107. In lieu of employing the flashing 106 (as shown in Fig. 8) a specially combined pan and flashing 114 may be utilized. As shown, this is formed on the interior with the typical edge flange 115 which cooperates with the stud 116 so as to be locked to the stud. The interior surface of this pan is aligned with the other pans constituting the interior wall surface. The lower flange 117, however, is specially conformed. As will be noted, this is of appreciable length and extends laterally to the window jam 107 and is there offset to form the terminal flange 118 which is associated and locked with the contiguous flange of the exterior pan unit 113. In all such installations, as will be observed, the inside area of the pan may be filled with suitable insulating material in the manner shown.

For interior corner sections a simple modification of the elemental pan unit serves to insure accurate and neat corner installations. As shown, such a corner formation may be comprised of the typical pan unit 120, one edge of which is locked by its flange 121 to the stud 122. The next pan 123, constituting the corner of the wall, is provided with the lateral flange 124, formed in the manner heretofore described, which is locked to the stud 125. The other flange, instead of being laterally displaced, constitutes in effect a continuation of the flat surface 123. At its end it is offset to provide the locking flange 123' which coacts with the flange 121 and stud 122 so as to securely lock the corner pans in permanent position. The gap between the adjacent flanges 121 and the flat face of pan 122 may be filled, in the manner described, with the mastic. It is to be seen then that the simple expedient of specially designing one or more of the edge flanges of a standard pan, substantially any type of assemblage mey be produced. One edge of the pan may be conformed (see pan 123) so as to provide the locking member for a simple interior corner. Again, one flange of the pan (see pan 114) may be elongated and specially conformed so as to serve as a, so to speak, window or door pan. In other words, by the simple expedient of a relatively few specially shaped pans, an entire exterior and interior wall construction may readily be assembled.

In the elemental unit or pan constructions thus far mentioned a particular type of locking mechanism is described. While this type, shown for example in Figs. 2 and 3, is very effective and is easily fabricated, it is clearly to be understood that other types of locking assemblages may be employed. The invention comprehends broadly the utilization of a pan or elemental unit member which may be positively locked to a stud or equivalent member to thus become a part of the finished structure. The locking section of the pan and the stud itself may be modified greatly while still subserving this fundamental function. By the proper choice of materials, gauges of metals, utilization of rigidifying members and the like, a wide variation in the strength of the pan and stud may be obtained. A typical modification of the stud construction is shown in Fig. 9. In this structure the pan unit may be the same as that hereinbefore described and shown particularly in Fig. 2. The adjacent pans 1 are, as previously described, provided with the adjacent flanges 3 and 5. These are offset inwardly and extend to form the terminal flanges 9 and 12. The flanges 9 and 12 are provided with the punched out lugs 10 and 13.

The stud may be similar to that shown in Fig.

2 but modified to increase its strength and rigidity. This stud may comprise the bottom flange 20 which is bent as shown to form a plate portion and the upstanding webs 21 and 22. Portions of these webs are punched out to provide apertures into which the locking lugs 10 and 13 are resiliently projected and against which they positively lock, in the manner already described. This particular stud, as shown, may be provided with an additional web plate 130. This may be of the same or a different type of metal as that used for the stud 20 and is securely attached to the webs 21 and 22, preferably by spot welding. This separator web, being spot welded to the webs 21 and 22, becomes in effect an integral part of the stud, markedly improving its strength and rigidity but without impairing the resiliency of the terminal portions of the webs 21 and 22, that is to say without impairing the locking function of the stud.

If desired, and as intimated above, other specific types of locking means may be employed. For example, as shown in Fig. 10, a lock of the modified bayonet slot may be used. In this structure the locking flange 140 of a pan unit is adapted to be nested or enclosed between the parallel webs 141 and 142 of the stud 143. As shown by dotted line 110 the flange 140 of the pan unit is cut along the lines 144, 145, 146 and 147 to provide a slot type of formation. The webs of the stud member are so cut and conformed as to form a small stud on which the slot of the locking flange 140 is locked. As shown, the flange 141 may be cut out, as at 148, and the cut out portion reversely bent to form a lip 149. The edge 150 of this lip portion forms an abutment over which the pan member is forced and which serves to lock the pan against outward movement by engagement with the lip 147 of the pan.

In assembling this type of structure, as will be appreciated, the pan is inserted in the stud above the cut and, after insertion, is forced downwardly so that the lip 147 on the pan flange engages the lug or lip 149 of the stud flange. This modification, or bayonet type slot, as will be appreciated, may be widely modified as to design. In this particular type of installation the locking stud 143 may be provided with a spacer web spot welded to the webs 141 and 142 to increase the strength and rigidity of the member.

It will be appreciated that the stud member may be a built up member of very rugged construction. This may be done in different manners, a typical example of which is shown in Figs. 12 and 13. In this example two channel irons 150 and 151 may be utilized. These may be placed back to back with the spacer 152 interposed therebetween and the unit spot welded together. In these circumstances there is provided a space between the adjacent flanges 150' and 151' into which the locking flanges 153 and 154 of standard pans may be inserted. The flanges 150' and 151' may be punched out after the manner of the structure shown in Fig. 3 so as to coact with similarly conformed lugs on the locking flanges of the pan to lock the two together. However, other types of locking means may be employed. For example, as shown in Fig. 13, the flanges 150' and 151' may be cut out to form the slot 155. A circular aperture 156 may be punched out in the locking flanges of the pans. This type of structure presents a simple form of locking mechanism. After the pans have been inserted in place so that the apertures in the locking flanges of the pans register with the slots 155, a wedge or similar locking device 157 is then forced into the aperture and driven in to thus draw in the pan and lock it tightly in place. This type of structure is particularly suitable for installation of the pans on the heavier type of beam members.

It will also be understood that the locking flanges of the pans may be provided with locking means of sufficient resiliency to be employed with rigid or non-resilient studs. Thus the flanges, at spaced intervals may be cut through in the form of a T and the adjacent triangular sections thus formed folded back to provide resilient lugs which, during insertion of the pan in the stud compress and then spring back to lock the pan to the stud.

It is to be understood that the types of locking mechanism herein described and shown particularly in Figs. 2, 10 and 11, are merely given to illustrate the broad functional coaction between the pans and the studs and to illustrate the wide range of specific mechanism which may be employed. Any suitable type of simple mechanism whereby the pans may be positively locked in place on the stud may be utilized.

It will be seen that the type of structure hereinbefore described presents marked advantages. The pans themselves, being of simple design and conformation, may be produced cheaply and in quantity. As indicated, the surface characteristics or effect of the pans may be modified over an extremely wide range to produce almost any desired artistic or technical effect.

Furthermore, by relatively simple modifications in design, certain of the pan members can be conformed so as to be utilized for the more complicated sections of the structure, such as interior and exterior corners, window and door connections, and the like. In all such modified forms, the same essential principle is involved and the same essential function subserved. The studs or members to which the pans are locked may, as noted, be relatively light gauge or relatively heavy gauge metals; in other words, these studs may be of any desired size and strength and may be considered either as separate studs or as part of the main structure of the building, such as sills, beams, joists and the like.

It will be appreciated that because of the relatively simple form and structure of the pan units they are susceptible of simplified handling and transportation. The preferred form of the invention, and particularly where pans for interior surfaces are being shipped, comprehends a special pan container. This type of container may present the main characteristics of the one shown in Fig. 14. In this figure the container or crate 160 is constructed of a size suitable to receive the pans. Along the opposite sides of the interior of the crate and at the top and bottom there is provided a series of slotted frames 161. The frames 161 may be of either wood or metal and, as noted, are provided with the slots 162. These slots are wide enough to readily receive the flanges 6 and 7 of the pan units. In shipping a series of pans, therefore, the pans may be packed in nested position so that the flanges 9 and 12 of one pan extend down over the flanges 5 and 3 of the next subjacent pan.

The slots 162 in the crate 160 are so spaced that they are adapted to receive the flanges 6 and 7 of the group of pans which have been nested in the manner described. With this type of crate, therefore, the pans are locked in position

and jarring of the pans and consequent scarification or fracture of the surface finish is avoided. While the type of crate shown in Fig. 14 and described above serves effectively, any other container or crate functioning similarly may be utilized.

As indicated hereinbefore, the improved method of house construction also includes a novel type of floor unit. This floor unit also utilizes, in a broad sense, the concept of a standard pan construction. As shown in Fig. 15, the floor unit comprises a specially formed metal sheet **300** which is conformed in the manner shown; that is to say, it is conformed of the separate flat sections **301** and the intermediate continuous offset sections **302**. Between the sections the metal is formed on the taper so as to provide, in effect, a series of dove-tailed offset sections. At the end of each unit section the metal plate is offset to provide the terminal flange **304** and this flange may be provided with the laterally extending marginal lip **305**. The opposite end of the section is provided with the shorter marginal lip **306** (see Fig. 2). When the sections are assembled end to end in the manner shown in Fig. 15, the flange **306** abuts against flanges **304** and **305**, thus definitely insuring its proper location and setting.

As will be observed from an inspection of Fig. 16, the metal of sections **302** extends the full width of the unit and terminates in the vertical flange **307**. This flange is provided at the spaced intervals with the apertures **308** through which locking means, such as bolts, rivets, wedges and the like may be inserted for the purpose of locking the adjacent flanges together.

In utilizing this type of structure the metal frame member **300** may be made up in the manner shown and there then may be inserted a suitable insulating material **310**. This insulating material may be of well known types of matted fibers, such as Celotex, impregnated cellulose products, and the like. If desired, and as will be appreciated, the insulating material **310** may be of more massive construction and may be comprised of suitable plastics. In this latter case such material can be set in place at the factory by utilizing a suitable mold. As will be seen, the floor member is adapted to be mounted on suitable supporting beams and is adapted itself to directly mount the finished floor. For this purpose the flooring **311** may be set in place on the assembled units by utilizing a coating of mastic **312** of any suitable character.

With this type of construction it will readily be seen that a complete floor unit may quickly and accurately be assembled. As will be seen from an inspection of Fig. 16, the separate units are adapted to be abutted to thus form a substantially continuous upper surface and at the point of abutment are suitably supported. A typical method may comprise the utilization of the two channel irons **315** and **316**. With these are employed the rigidifying metallic separator **317** and the unit may be formed in an integral element by spot welding. The channels **315** and **316** are provided with the base webs **318** and **319** respectively. By means of these webs the beam and its superstructure may be supported upon suitable sills. The upper flanges **319** and **320** of the beam are adapted to abut the insulating material **310**. The abutting flanges **307** of the adjacent assembled units project downwardly into the space between the channels **315** and **316**. The metal units are thus adapted to be permanently secured to the supporting beam by suitable means, such as the rivets **321**. It is to be observed that the entire floor is supported in part by the flanges **319** and **320** of the several beam units and largely by the positive locking of the vertical flanges **307** of each unit, such flanges being directly locked in the supporting beam. In these circumstances, as will be appreciated, a large portion of the supporting area is comprised of a non-metallic contact, thus improving the sound insulation characteristics of the structure.

As will be appreciated, the floor pan units may be made up in different sizes and utilizing metals of different gauge. As a typical example, the floor units of the type herein shown may be approximately 20″ wide and of any desired length.

It will be observed that since the insulating material is held in the metal by the dovetail only, such material together with the finished floor attached to it may be driven into an adjoining dovetail pan and any open joint in the floor may be closed. In other words points in the floor may be closed in two directions, thereby producing a shop manufactured, structural and finished floor capable of easy assembly.

It will be understood that this simple type of structure lends itself very readily to modification either at the point of production or at the point of construction for the purpose of increasing the strength. For example, as shown in Fig. 17, the strength of a unit under compression loads may be very markedly increased by utilizing metal inserts. For example, metal inserts may be produced in standardized shapes so as to be utilized, when desired, with the floor units. Such inserts may comprise the specially conformed channel members **330** and **331**. It will be observed that these each comprise a horizontal and a vertical flange and a separate angularly projecting flange **332**. These units may be assembled in the manner shown by placing the vertical flanges back to back and integrally attaching the two, as by means of spot welding, rivets and the like. In utilizing such an insert it will readily be seen that it may be inserted into the dove-tail section **302**. This insert extends entirely across the unit and at its end abuts the vertical flange **307**. But utilizing these inserts with the standard frame, substantially any desired strength and rigidity may be insured in the finished structure. In other words, a standard unit floor pan or frame may be made up and may be so designed as to be utilized in the section of least stress. This same pan, however, may be employed in sections subjected to greater stress by the simple expedient of insertion of the special strength imparting inserts.

It is to be observed that for some installations it may not be necessary to provide a beam support **315** under the joint of each contiguous frame member. In circumstances where this is not required, it will readily be appreciated that the units may be locked together merely by inserting bolts, rivets, nuts and the like through the registering apertures **301** in the contiguous flanges of the adjacent units. As will be appreciated, the supporting beams **315** are of typical I-beam construction, said I-beam being formed from two channels back to back welded together similar to studs formerly described. The floor unit defined, that is to say the groups of assembled pans, together with the supporting beam members **315**, may be mounted upon suitable primary supports in the manner well known to those skilled in the art. The use of gusset plates to

connect the beams to the studs would produce proper centering for floor construction without further effort in erection.

It will thus be seen that this type of structure insures marked economies in production and marked improvements in installation and ultimate construction. The stress taking members of the structure are made up of suitable high strength metals which may be fabricated in standard units but which, by the expedients mentioned, may be modified at the site to increase the strength of the units so as to adapt them for substantially any desired size of structure.

The utilization of these floor units in conjunction with the elemental wall pan units hereinbefore described provides a method of constructing a house of the optimum characteristics of strength, appearance and durability with the minimum amount of expenditure in materials of construction, installation, time and labor.

While the invention has been illustrated by means of specific structural embodiments, it is to be understood that these are given didactically to typify and illustrate the underlying principles of the invention and are not to be taken as the exclusive means by which the principles of the invention may be effectuated.

I claim:

1. A construction unit of the class described comprising a metal member having an imperforate face plate of substantial area, said plate being formed with laterally extending flanges, certain of the flanges being provided with offset sections and a straight section below the offset section said straight section being formed with projecting resilient locking lugs.

2. A construction unit of the class described comprising, a metal member having an imperforate face of substantial area, said member having laterally extending flanges of differential depths along two opposite sides and having laterally extending locking flanges on the other two opposite sides, the locking flanges comprising two parallel elongated webs joined by an intermediate offset web, which offset web is adapted for abutting engagement with a structural member of a building and one of which elongated webs is adapted for positive locking engagement with said structural member.

3. A construction unit of the class described comprising, a metal member having an imperforate face of substantial area, said member having laterally extending flanges of differential depths, along two opposite sides and having laterally extending locking flanges on the other two opposite sides, the locking flanges comprising two parallel elongated webs joined by an intermediate offset web, which offset web is adapted for abutting engagement with a structural member of a building and one of which elongated webs is adapted for abutting engagement with a similar unit and for positive locking engagement with the said structural member.

4. A wall structure of the class described comprising a series of studs on the line of the wall, such studs having locking means thereon, and being formed with angularly projecting terminal flanges; a series of metal pans mounted on the studs, each pan of the series being provided, on opposite sides thereof, with a deep lateral flange and an intermediate off-set portion, locking means on the flange such that the said off-set flange portions abut the said terminal flanges of the stud and the locking means of the pan flanges engage the locking means on the stud.

5. A wall construction of the class described which comprises a series of studs on the line of the wall, each stud having a locking means thereon and each stud being formed with angularly projecting terminal flanges; a series of metal pans mounted on the studs, each pan of the series being provided on opposite sides thereof with a deep lateral flange having an intermediate off set portion and locking means on the flange; resilient insulating material mounted on the pan and between the said flanges; the arrangement being such that the said terminal flanges of the stud abut the off set flange portions of the pan flanges and comprises the contiguous portions of the insulating material when the parts are in locked position.

PHILIP M. JULLIEN.