April 28, 1936. W. E. S. STRONG 2,038,967

COMPOSITE BUILDING UNIT

Filed May 25, 1934 2 Sheets-Sheet 1

Fig. 1.

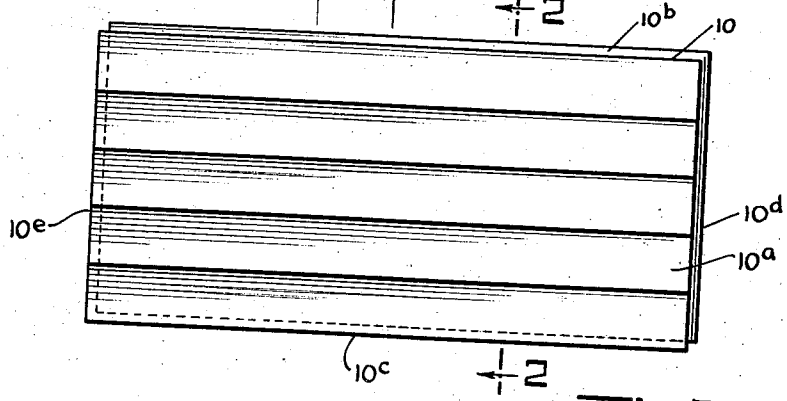


Fig. 2.

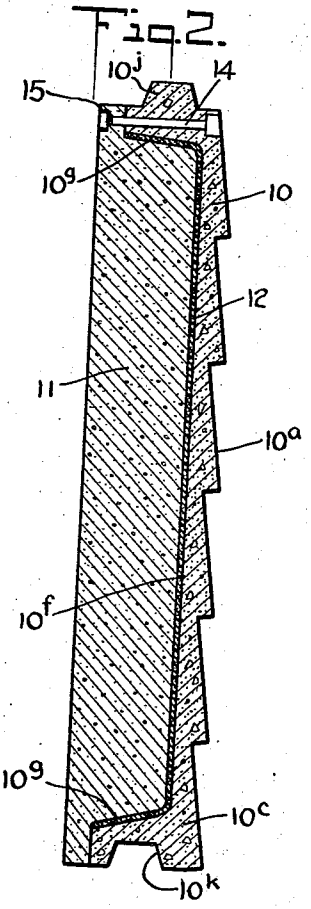
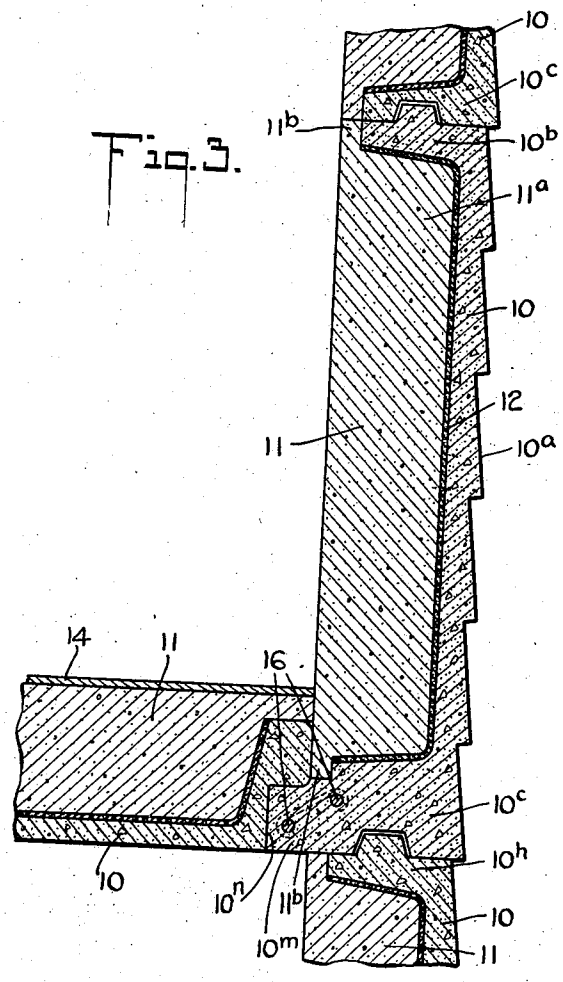


Fig. 3.



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Fig. 4.

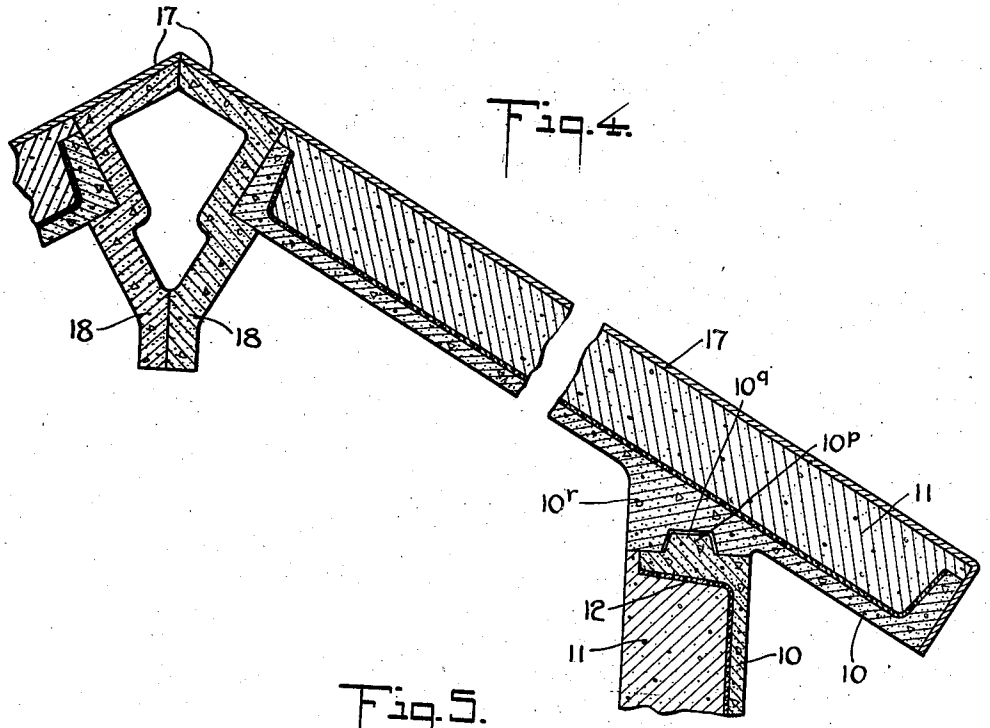


Fig. 5.

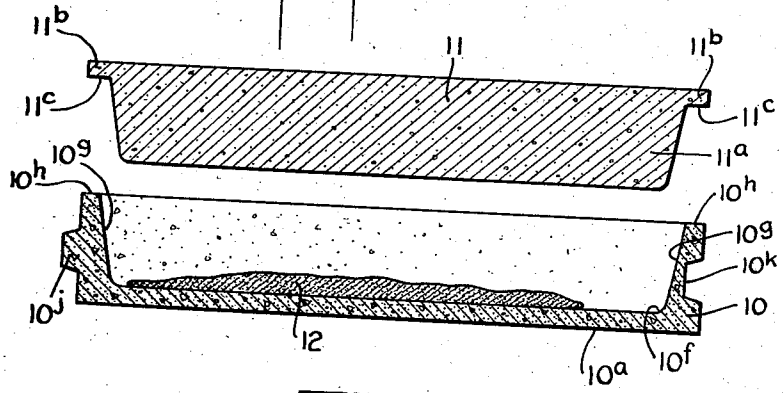
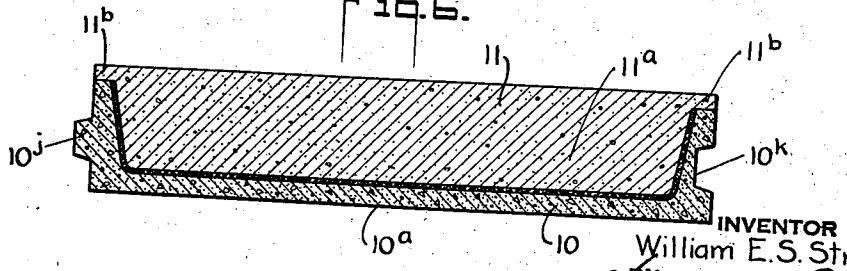


Fig. 6.



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COMPOSITE BUILDING UNIT

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Application May 25, 1934, Serial No. 727,383

9 Claims. (Cl. 72—35)

My invention relates to composite building units.

A feature of my invention resides in the employment of an outer member, such as concrete, molded to suitable dimensions, and an inner member possessing essentially lesser unit weight and low heat conductivity, the outer and inner members being unitarily combined and a medium possessing essentially the properties of water and moisture proofness interposed between the juxtaposed faces of the inner and outer members.

Composite material such as blocks of indurated chemical compositions of siliceous material and calcareous material with or without asbestos or like fibers, of microporous structure and the like are suitable for the material of such inner member, and possess the qualities of appreciably low unit weight as compared with material of the character of concrete as well as relatively high heat insulation.

A mixture of latex and alumina serves admirably as such medium, and additionally functions to cement the inner and outer members to one another.

My invention embodies, interalia, the utilization of the properties of concrete or the like of moldability to varied configuration of exposed face, and of resistance to weather conditions, and the further quality of imparting proper strength against crushing, such concrete member being formed of hollow configuration to present a cavity for the reception and retention of the inner member. The inner member is preferably of less dense, and may be of porous, physical constituency, and is molded or otherwise shaped to partially project within the recess or hollow interior of the outer member and to provide a clearance between the inner faces of the outer member and the therewith juxtaposed faces of the projecting portion of the inner member, such clearance being preferably filled with the medium functioning to impart water and moisture proofness, and preferably additively bonding connection.

The inner and outer members may be mechanically interconnected, as by bolts, tie rods, etc., desirably of steel, supplemented by the cementing quality afforded by the medium.

The resulting unitary building element possesses an average unit weight appreciably less than that of concrete or equivalent. The concrete or equivalent member of my building element possesses the required tensile and crushing strengths and imparts these qualities to the resulting building element. Low heat conductivity is imparted to my unitary building element by corresponding quality of the inner member component. Usually, as is the case with the stated porous siliceous calcareous composition, the quality of sound-proofness is imparted additionally to that of low heat conductivity.

The stated or equivalent bonding medium imparts water and moisture proofness to the resulting unitary building element.

The most preferred forms of my invention embody a configuration of the inner member to provide for direct engagement of the inner member with the outer member at areas other than at the inner faces of the recessed or hollow portion of the outer member thereby positively insuring substantially uniform clearance between the inner faces of the recessed or hollow portion of the outer member and the therewith juxtaposed faces of the inwardly projecting portion of the inner member.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings, in which

Fig. 1 is a front elevation of a building unit embodying my invention, applicable to an outer wall.

Fig. 2 is a vertical sectional elevation of Fig. 1, the outer or exposed face, incidentally illustrating a clapboard configuration.

Fig. 3 is a vertical sectional elevation of a plurality of associated building units, inclusive of that shown in Figs. 1 and 2, applicable to outer wall and floor assembly, each embodying my invention.

Fig. 4 is a vertical sectional elevation of a plurality of associated building units applicable to a roof and girder assembly.

Fig. 5 is a vertical sectional elevation illustrating a step of my method of assembling an inner member and an outer member pursuant to my invention.

Fig. 6 is the composite building unit resulting from the procedure illustrated in Fig. 5.

The particular embodiments appearing in the drawings are representative of various types of building units and assemblies thereof, to which my invention is applicable, and it is understood that the embodiments shown in the drawings serve primarily as illustrations and not in limitation of the scope of my invention.

Referring to Figs. 1 and 2, the outer member 10 illustrates a block or slab applicable to an outer wall construction of a house or other structure, its outer face 10a being designed as a part of the

exposed face of the outer wall, in this instance in simulation of clapboard.

Such outer member having such configuration and contour of its exposed face as may be desired, is preferably formed of concrete, such as Portland cement, hydraulic cement, natural cement or the like, with or without suitable aggregate such as gravel, sand or the like, in a suitable mold, an essential of the structure of the outer member being the provision of a cavity for the reception therein of the inner member 11, and preferably, also to provide an upper end portion 10*b*, see Figs. 1 and 2, a lower end portion 10*c*, and the side portions 10*d* and 10*e*.

Such upper and lower end portions 10*b*, 10*c*, preferably, cooperate with complementary juxtaposed portions of adjacently associated duplicate or similar building units.

The above construction has been described by reference to an outer wall; like parts and like relationship apply to an inner wall, partition and the like.

My invention is correspondingly applicable to units for floor and ceiling assemblies, roof and girder assemblies, etc.

In the specific building unit illustrated in Figs. 1 and 2, 10*f* indicates the face of the cavity extending substantially parallel to the exposed face of the outer wall unit, which face is herein defined as the inner base face; 10*d* indicates the inner faces of the side walls of such cavity. The inner faces 10*g* are preferably convergently tapered in the direction inwardly of the cavity, as will appear more fully from the relation of the inner member with respect to the outer member.

The member 11 is essentially of lesser unit weight as compared with the material of the member 10.

As illustrated in Figs. 1, 2 and 3, the member 11 comprises essentially a body portion having projecting portion 11*a* arranged to be received within the cavity of the member 10. The member 11 preferably comprises further the edge portions 11*b* which extend integrally from the body of the member to the respective side edges of the member.

It will be understood that the outer contour of the member 10 may be of any desired polygonal or other suitable contour, and further that the contour of its cavity may be of any polygonal or other suitable contour, the contour of the member 11 and of its projecting portion being in correspondence therewith.

A porous composite of siliceous and calcareous ingredients serves admirably as the material of the member 11, such material and/or its porosity functioning to impart heat and sound insulation, additive to its property of lower unit weight as compared with concrete or equivalent material of the member 10.

The edge portions 11*b* are dimensioned with respect to the dimensions of the faces of its projecting portion 11*a* and with respect to the base face 10*f* and the inner faces 10*g* of the member 10 to provide a predetermined clearance between the stated faces. If desired, such clearance may be substantially uniform. Such clearance functions to receive, as appears more fully hereinafter, a medium 12 which serves primarily to bond the member 10 and the member 11 to one another.

Such bonding medium preferably possesses the attributes of forming a liquid and moisture proof seal between the member 10 and the member 11, additionally to its function of bonding the stated members to one another.

As appears from Fig. 3, in the instance of use of my composite building unit as a part of a wall, the exposed face of the member 11 may be coated with paint, wall paper or other customary decorative finish.

Reference is now had to Figs. 5 and 6, which illustrate a manner of assembling the member 11 with the member 10 by the instrumentality of the bonding medium 12, like parts of the indicated members corresponding to those shown in Figs. 1, 2 and 3 being designated by like reference characters. The mass of the bonding medium 12 is weighed-out to correspond within an approximate range to the volume of the predetermined clearance between the faces of the projecting portion 11*a* of the member 11 and the herein termed base face 10*f* and the side faces 10*g* of the cavity of the member 10. Such mass 12 is charged into the cavity of the member 10 and the member 11 is then approximately located with respect to its projecting portion 11*a* relative to the stated inner faces of the cavity of the member 10, and pressure applied. The provision of the edge portions 11*b* affords definite stops or limits of such insertion of the member 11 within the cavity of the member 10, namely, by the faces 10*c* of the edge portions 11*b* engaging the edge faces 10*h* of the member 10, and to insure proper register.

The product resulting from the procedure indicated in Fig. 5, is shown in Fig. 6, in which instance the mass of the medium 12 functions, after setting if required or maturing, to substantially fully occupy the clearance between the stated faces of the projecting portion 11*a* of the member 11 and the base and side faces of the cavity of the member 10 and to substantially firmly bond the member 11 to the member 10 and vice versa.

A mixture of latex and alumina has been found advantageous as the material of the medium 12; however, any other suitable mixture or composition or material functioning to impart water and moisture proofness, and such other desired qualities, to the joint between the inner and outer members may be employed, and thus impart corresponding qualities to the completed unit 10—11.

If desired, headed or other bolts 14 may be unitarily molded at appropriate locations in the member 10 and registering countersunk openings 15 in the member 11, or vice versa, may be employed to mechanically lock the elements 10, 11 to one another, as by means of nuts, etc.

The respective types of building units thus or similarly produced may be provided with supplemental means for facilitating assembly, registry, and also if preferred for effecting locking engagement of adjacently assembled building units to one another. Thus, a protuberance 10*j* may be provided at the upper edge of the upper end portion 10*b* of each member 10, as is illustrated in Figs. 2 and 3, see also Figs. 5 and 6, and a recess 10*k* complementary in contour to the protuberance 10*j* provided at the lower face of the lower end portion 10*c* of the upwardly adjacent member 10, serving as is indicated in Fig. 3 to assemble, register and interlock the respective superposed building units to one another. Projections or equivalent and recesses or equivalent may be similarly provided at the side and/or other faces of each or any member 10 applicable for the respective types of building unit assemblies, for like interlocking relation with adjacent assembled building units.

Exemplification of the stated structural features applied to a floor ceiling and wall assembly is indicated in Fig. 3. In such assembly, the building unit 10—11 constituted and assembled substantially as above described may serve as a floor and ceiling unit, in which instance as illustrated in Fig. 3, the outer face of a member 10 serves as the ceiling face and the member 11 serves as the floor material, in which latter instance the outer face of the member 11 may have a wear coating 14 of any suitable material or composition, preferably a coating material autogeneously bonded to the material 11.

In the application of my building unit to a floor and wall assembly, the mode of interlocking and supporting may be varied; as indicated in Fig. 3, each wall unit rising at the floor level may have a lower edge portion 10*m*, of increased extension relative to the upper edge portion 10*b*, to cooperate with a downwardly open ended recess 10*n* of the juxtaposed floor units, for effecting support independently of supplemental supporting means, additionally to interlocking of the floor with the wall.

Such floor and wall assembly is applicable to an inner wall or partition similarly as described with respect to an outer wall.

Fig. 3 also indicates tie-rods 16 or equivalent passing through registering openings in the members 10, affording mechanical interconnections of the respective assemblies of my building unit.

A bonding medium may be employed at the respective joints between juxtaposed building units.

Fig. 4 illustrates diagrammatically another embodiment and a manner of application of my invention, namely, to a roof assembly; parts corresponding to those hereinabove described are designated by like reference characters.

Specifically, Fig. 4 illustrates a saddle type of roof and a therewith combined wall assembly. Similarly as in the hereinabove described types, the uppermost tier of the wall units 10—11 may be provided at their upper edges with projections 10*p* received within, and bonded if desired, to recesses 10*q* of the lowermost line of roof elements 10—11. Such lowermost roof elements 10—11 may be provided with downwardly extending projections, see 10*r*, located in spaced relation to the depending edge portions of each such unit as may be preferred.

Desirably, the otherwise exposed faces of the members 11 of the roof units may be coated with a water and atmosphere resistant surfacing material 17, which may be applied to the individual units or unitarily upon the roof units after installation.

Fig. 4 also shows a set of complementary hip or equivalent supporting elements 18, 18, suitably of concrete, serving to complete the assembly of the roof units, as for a saddle type roof, and correspondingly appropriately designed for other types of roofs, the details of such hip or equivalent supporting and interlocking members being indicated in Fig. 4 and correspondingly designed for any particular type of roof desired.

From the above, it will be observed that my invention provides for a building unit formed of a member of material of the character of concrete constituting the major strength-imparting component of the unit, suitably recessed for the reception of and combined with a member of a material of less unit weight and imparting sound and heat proofness to the resulting building unit.

My invention, as is apparent, results in a multi-component building unit comprising a hollow formed member serving as the strength-imparting component, and a member of less unit weight received within and preferably wholly filling the hollow interior of the strength-imparting member, the same being bonded to one another as a unitary building element.

As appears from the above, my invention provides for a unitary building element comprising a member imparting strength to the building element, such member being of hollow formation, and a member wholly or partly of a material of less unit weight associated with and projecting within the hollow interior of such first-named member and bonded thereto by an intermediately disposed medium, preferably effecting a water and moisture sealed bond therewith.

The material of the hollow member of my unitary composite building element, as appears from the above, being of concrete or the like is particularly advantageous for use for the outer wall in whole or in part of a building or other structure arising from its qualities of resisting the effects of the atmosphere, such qualities being also of importance in the use of building units as walls, partitions and the like which are or may be subjected to exposure to water and/or moisture, variation of temperature, etc.

The concrete or equivalent component of my building element formed, for example from Portland cement, hydraulic cement, natural cement may be treated as by vibration treatment, pressure treatment, etc. to attain optimum mechanical strength per unit weight and/or supplemented by metal and/or other reinforcement. The assembly of such or equivalent strength-imparting component with the lesser unit weight component results in a combined building unit of minimum total unit weight, proper evaluation being made for the desired factor of safety.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. A composite building element comprising a member of material of the character of concrete, said member having a recess, an exposed face of said member having a configuration suitable for the exterior of the building, the faces of said member lateral to said exposed face being formed with complementary interlocking formations, a member of material of lesser unit weight and possessing the quality of heat insulation extending within said recess, and means for bonding said member of the character of concrete and the said member of material of lesser unit weight and possessing the quality of heat insulation to one another.

2. A composite building element comprising a member of material of the character of concrete, said member having a recess, and a member of material of lesser unit weight and possessing the quality of heat insulation extending within said recess, said members being bonded to one another by a water and moisture proof medium.

3. A composite building element comprising a member of material of the character of concrete, said member having a recess, and a member of material of lesser unit weight and possessing the quality of heat insulation extending within and dimensioned to provide a clearance at the effective faces of said recess, said members being bonded to one another and a medium pos-

sessing the quality of water and moisture proofness substantially filling said clearance.

4. A composite building element comprising a member of material of the character of concrete, said member having a recess, a member of material of lesser unit weight and possessing the quality of heat insulation extending within and dimensioned to provide a clearance at the effective faces of said recess, said members being bonded to one another and a medium possessing the quality of water and moisture proofness substantially filling said clearance, said medium serving to bond said members to one another.

5. A composite building element comprising a member of material of the character of concrete, said member having a recess, a member of material of lesser unit weight and possessing the quality of heat insulation extending within said recess, said members being bonded to one another by a water and moisture proof medium and means for mechanically unitarily connecting said members to one another.

6. A composite building unit comprising a member of material of the character of concrete, said member having a recess, a member of material of lesser unit weight and possessing the quality of heat insulation protruding within said recess, said member of material of lesser unit weight having a face arranged to be exposed to the inner atmosphere of a building, and adapted to have its face coated with a decorative finish, and means for positively limiting the extent of protrusion of said second-named member within the recess of said first-named member.

7. A composite building unit comprising a member of material of the character of concrete, said member having a recess, a member of material of lesser unit weight and possessing the quality of heat insulation protruding within said recess, said member of material of lesser unit weight having a face arranged to be exposed to the inner atmosphere of a building, and adapted to have its face coated with a decorative finish, means for positively limiting the extent of protrusion of said second-named member within the recess of said first-named member and a medium possessing the quality of water and moisture proofness bonding the juxtaposed effective faces of said members to one another.

8. A composite building unit comprising a hollow member of the character of concrete and possessing the quality of mechanical strength, and a member of less unit weight and possessing the quality of high heat insulation as compared with concrete or the like, said second-named member having a portion projecting within and substantially filling the stated hollow interior of said first-named member, said second-named member having a face arranged to be exposed to the inner atmosphere of a building, and adapted to have its face coated with a decorative finish.

9. A composite building unit comprising a hollow member of the character of concrete and possessing the quality of mechanical strength, a member of less unit weight and possessing the quality of high heat insulation as compared with concrete or the like, said second-named member having a portion projecting within and substantially filling the stated hollow interior of said first-named member and a medium imparting the quality of water and moisture proofness bonding said members to one another.

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