Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 1

FIG. 1

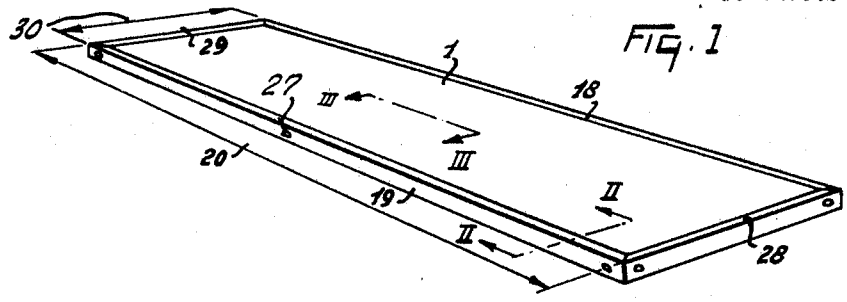
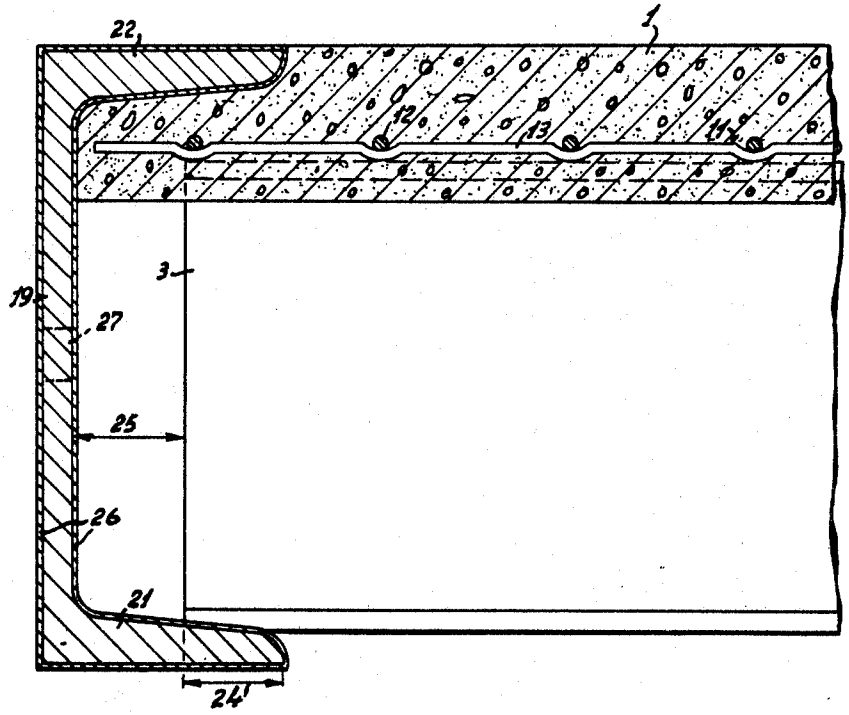


FIG. 2



INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 2

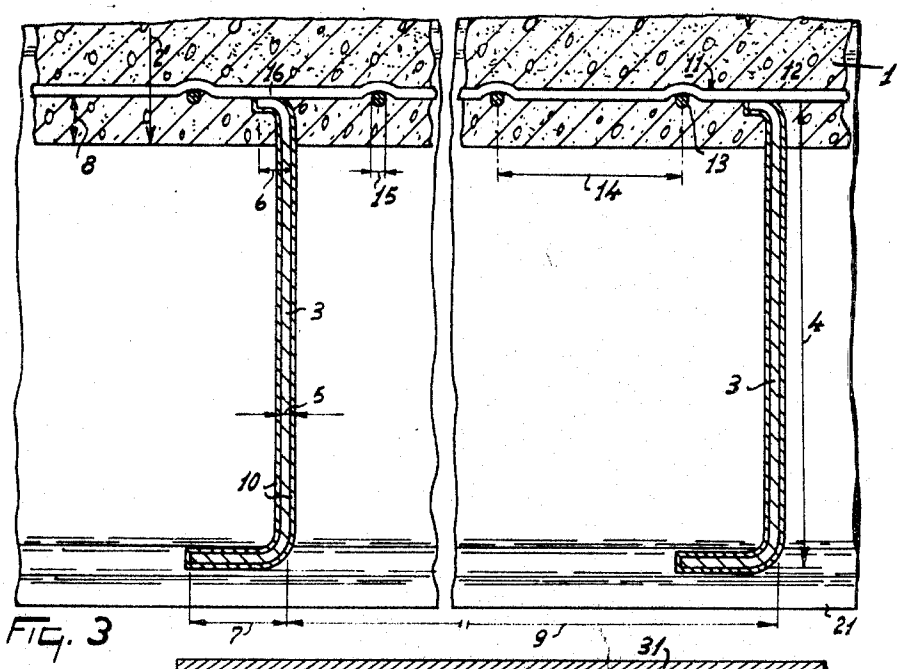


FIG. 3

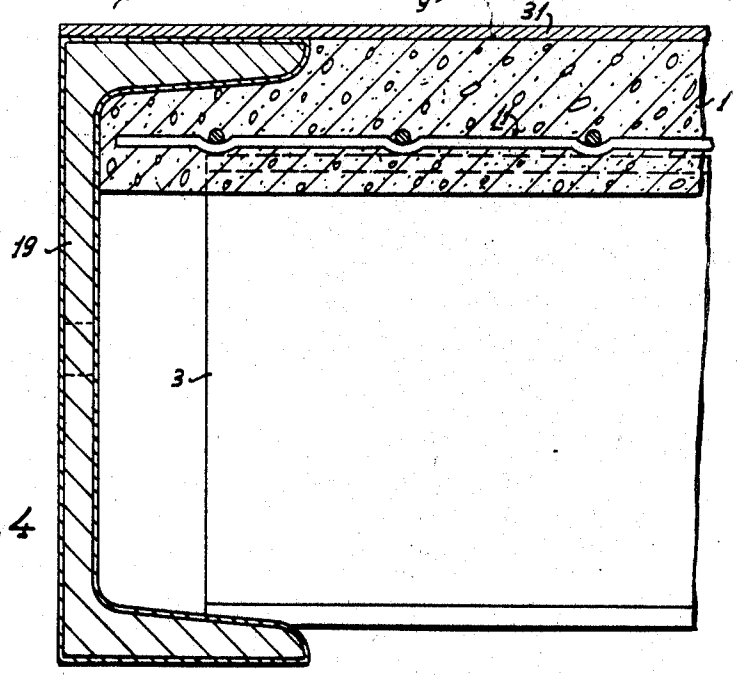


FIG. 4

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 3

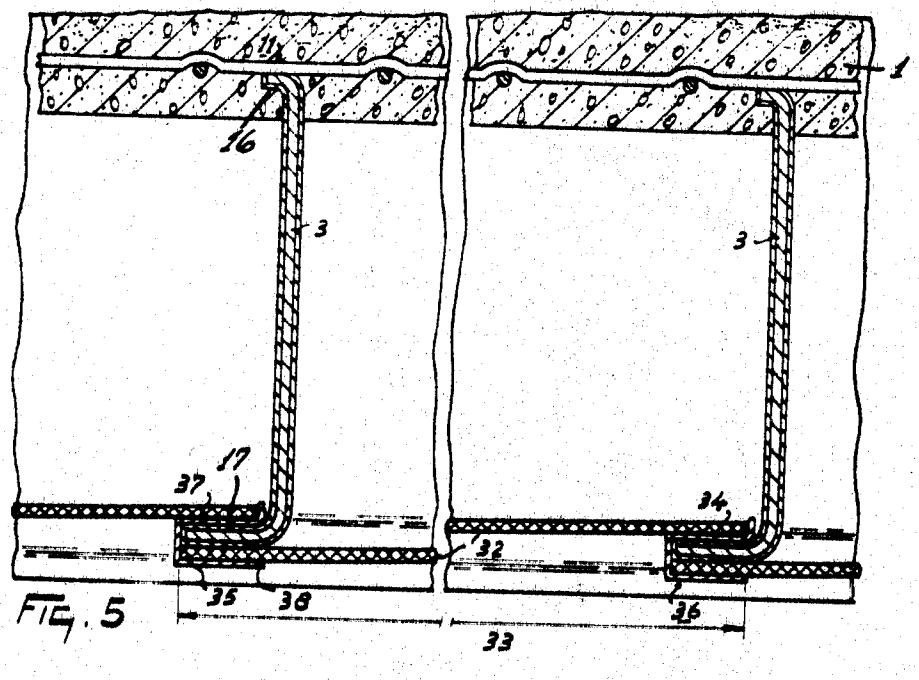


FIG. 5

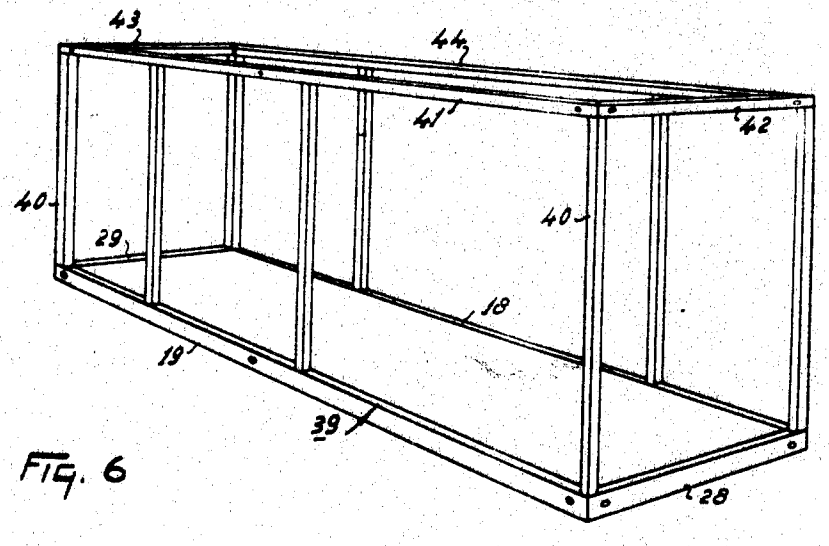


FIG. 6

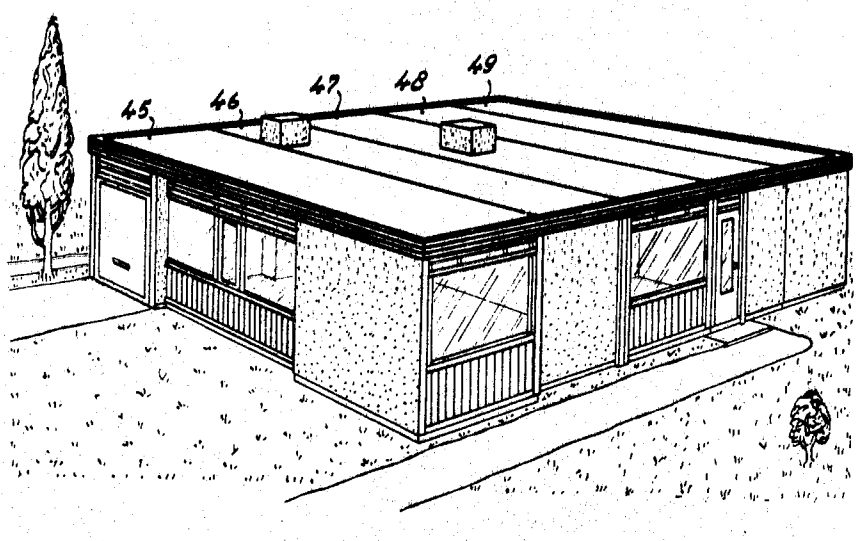
INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 4

FIG. 7



INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 5

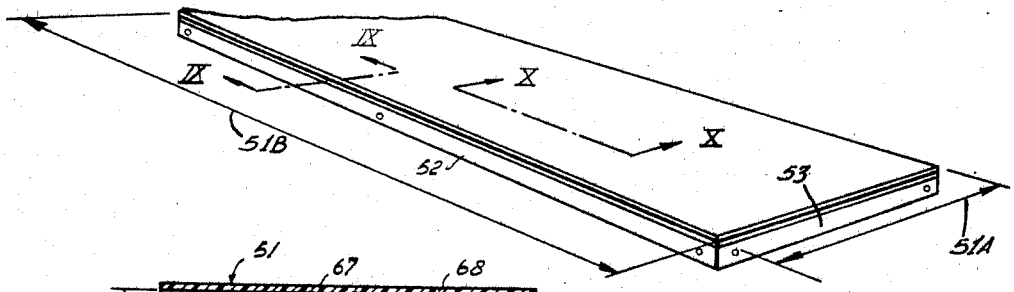


FIG. 8

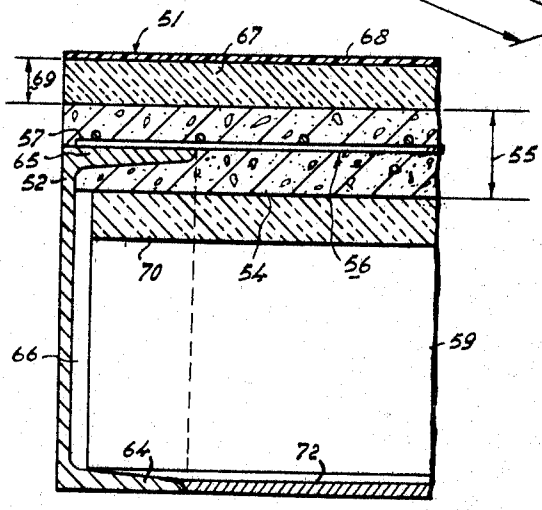
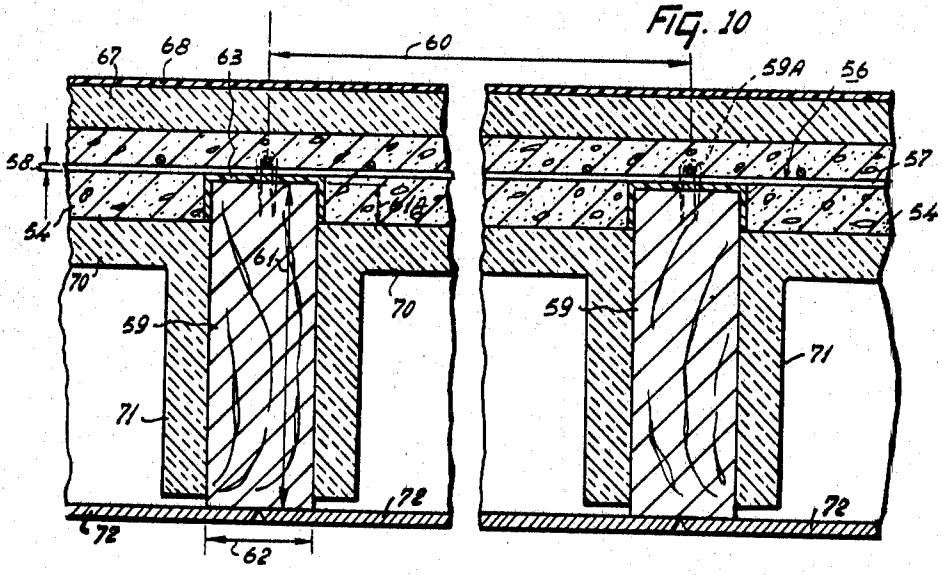


FIG. 9

FIG. 10



INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 6

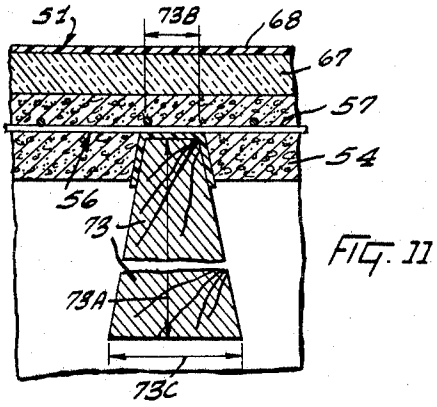
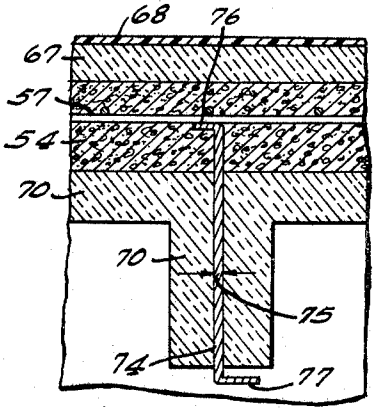


FIG. 11



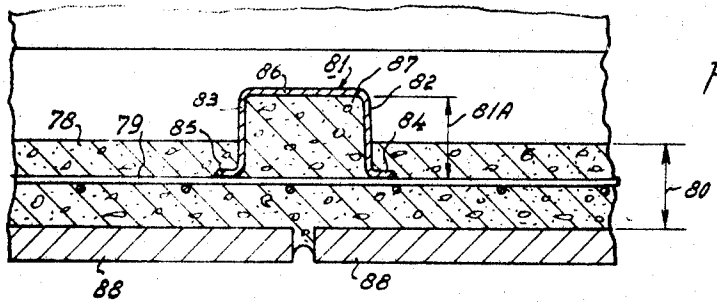


FIG. 12

FIG. 13

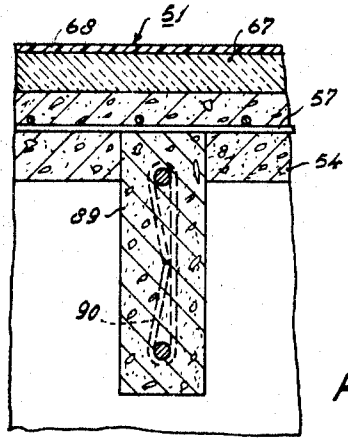


FIG. 14

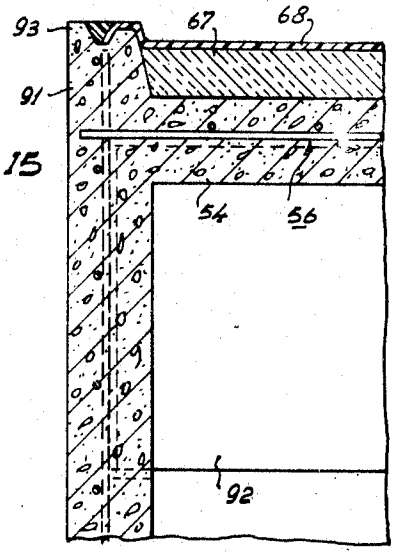


FIG. 15

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 7

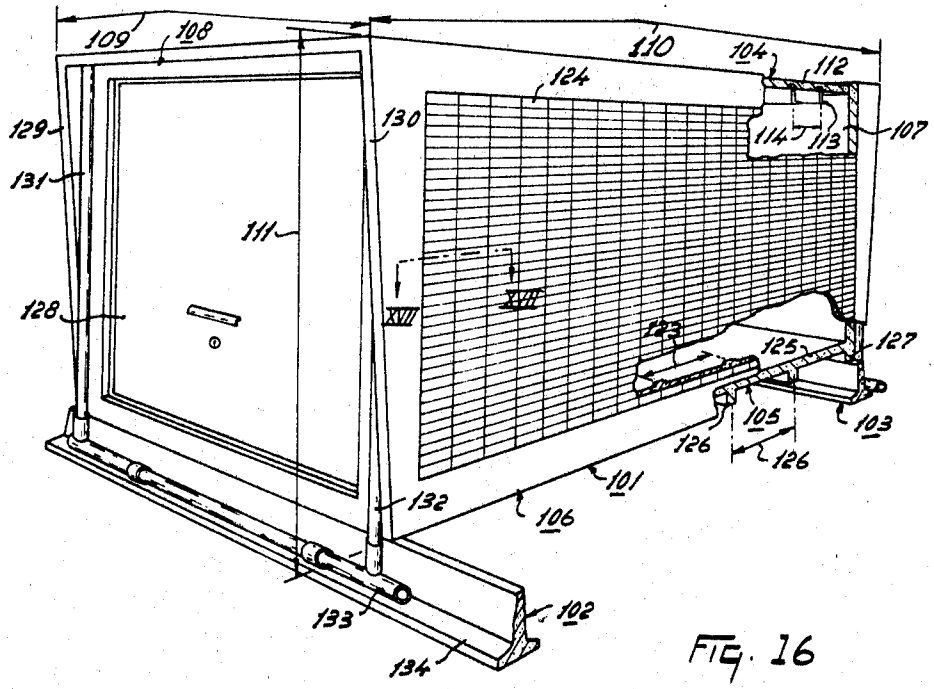
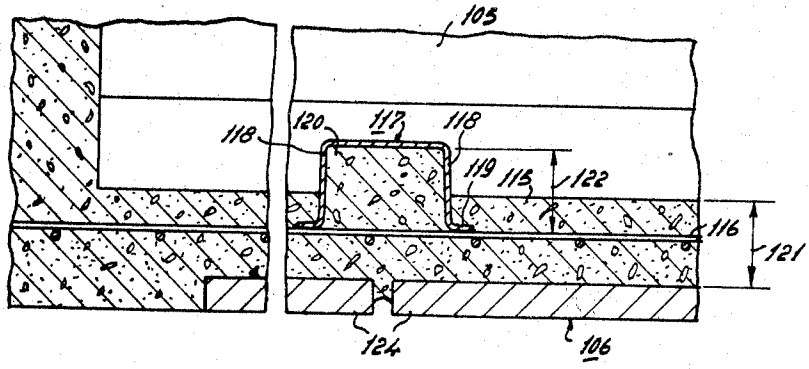


FIG. 16

FIG. 17



INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 8

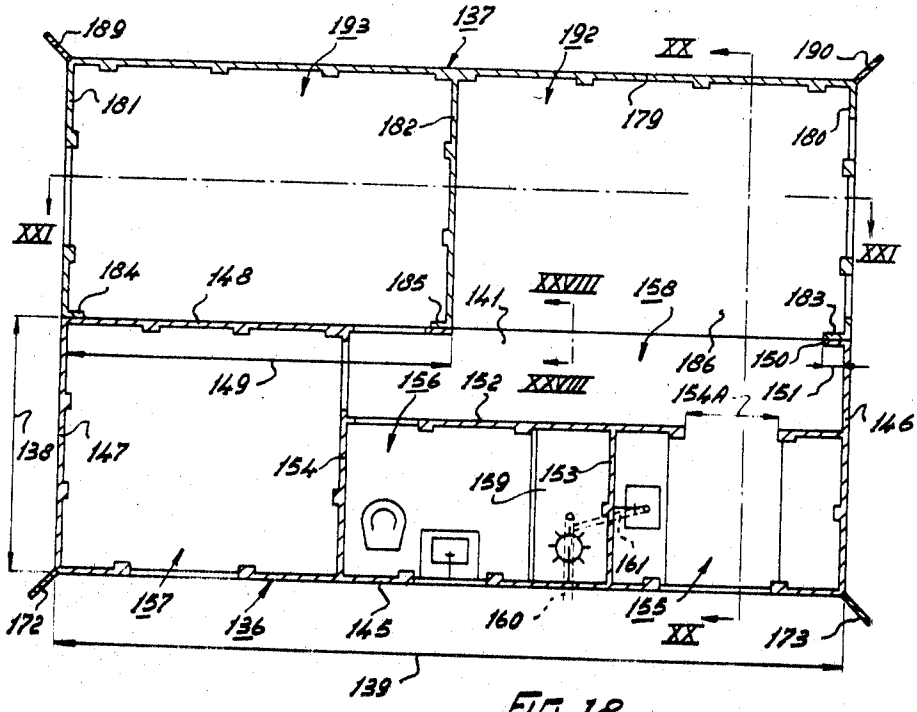


FIG. 18

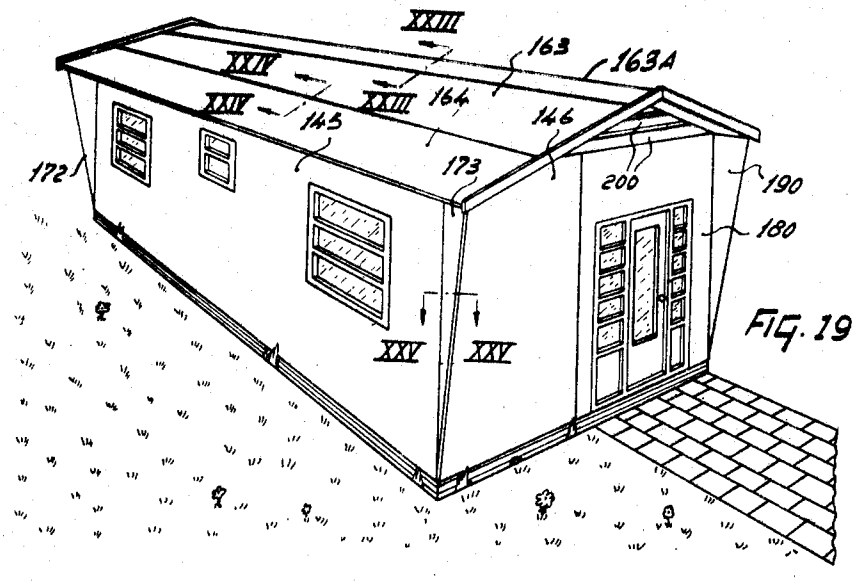


FIG. 19

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 9

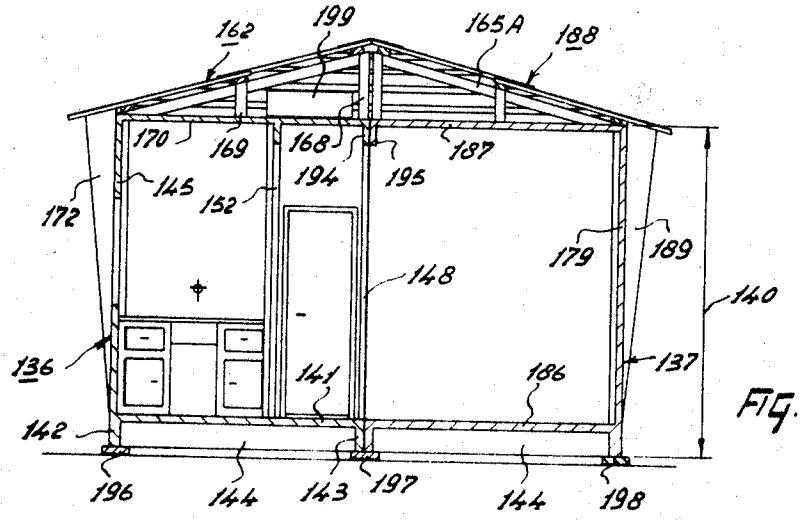


FIG. 20

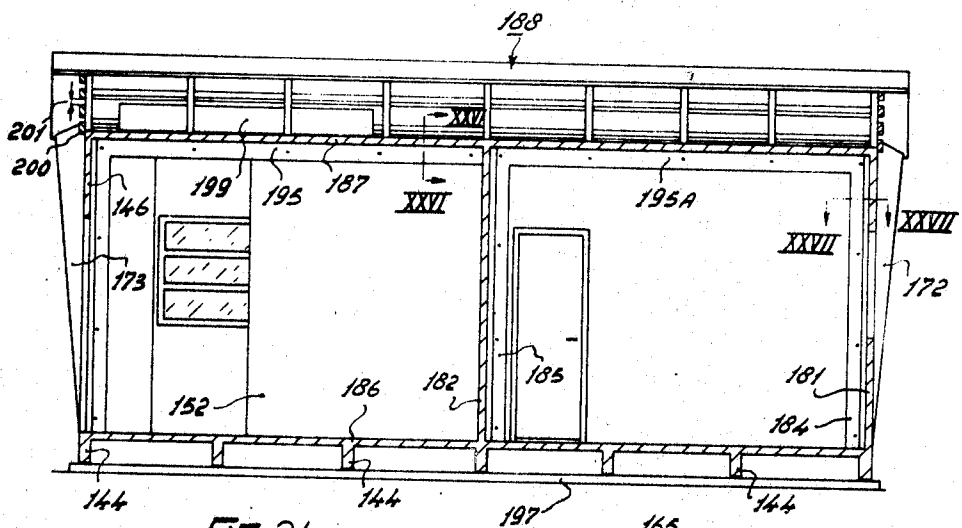


FIG. 21

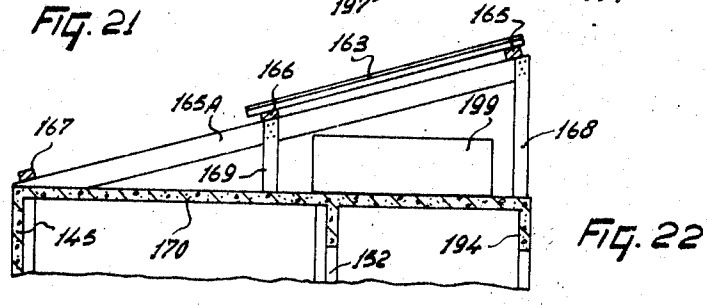


FIG. 22

INVENTOR.

CORNELIS VAN DER LELY

BY

Mason, Mason & Albright

Attorneys

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 10

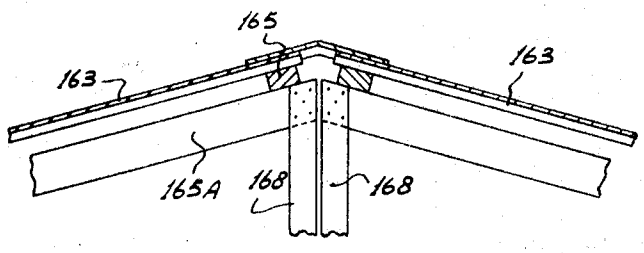


FIG. 23

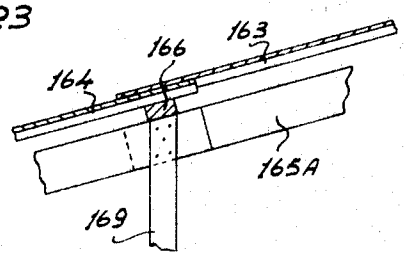


FIG. 24

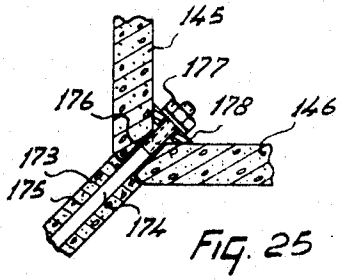


FIG. 25

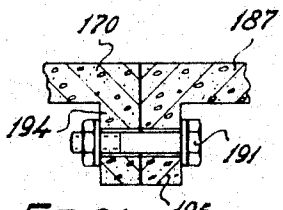


FIG. 26

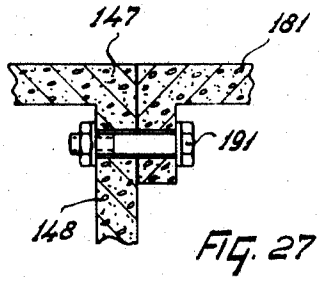


FIG. 27

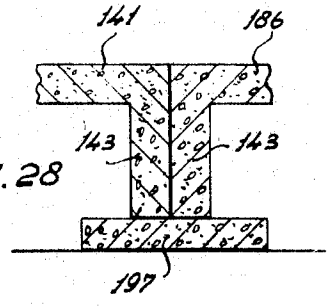


FIG. 28

INVENTOR.

CORNELIS VAN DER LELY

BY

Mason, Mason & Albright

Attorneys

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 11

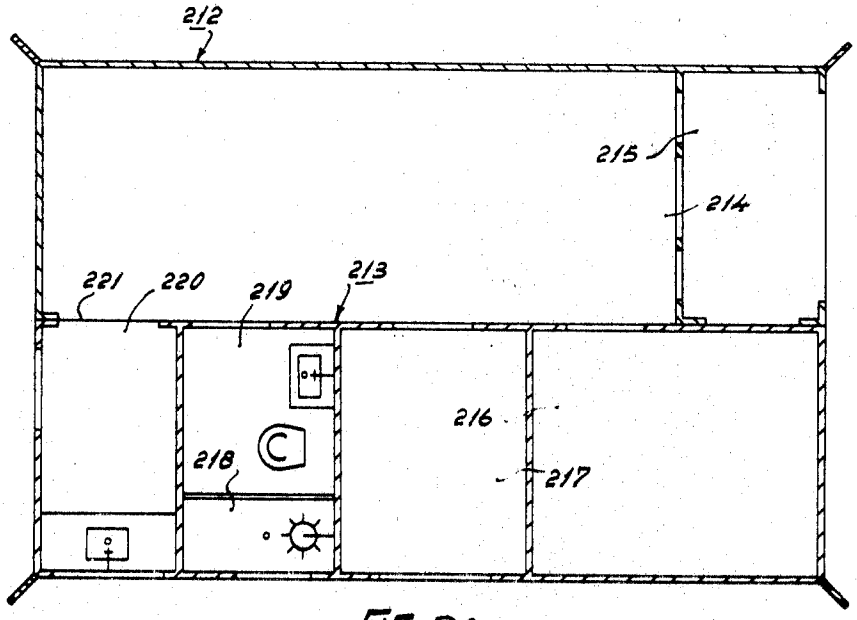


FIG. 30

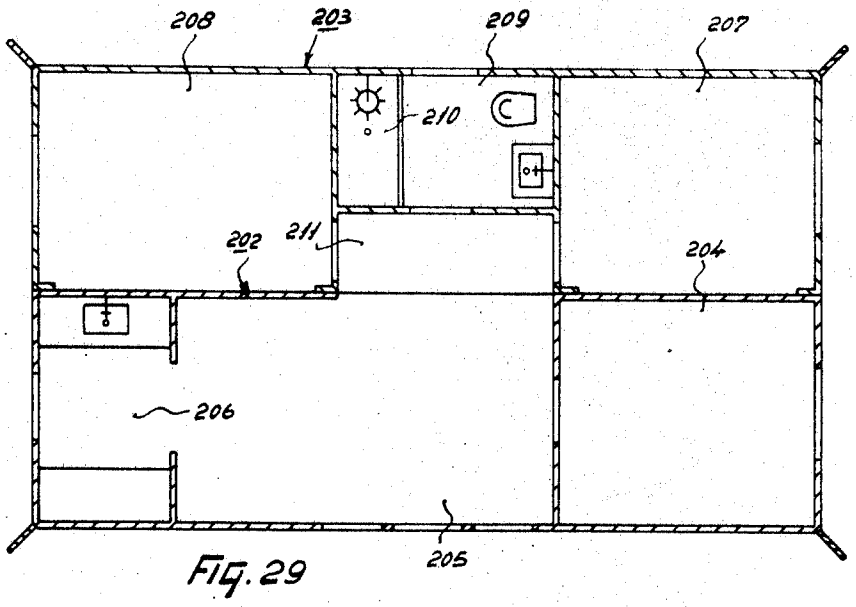


FIG. 29

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 12

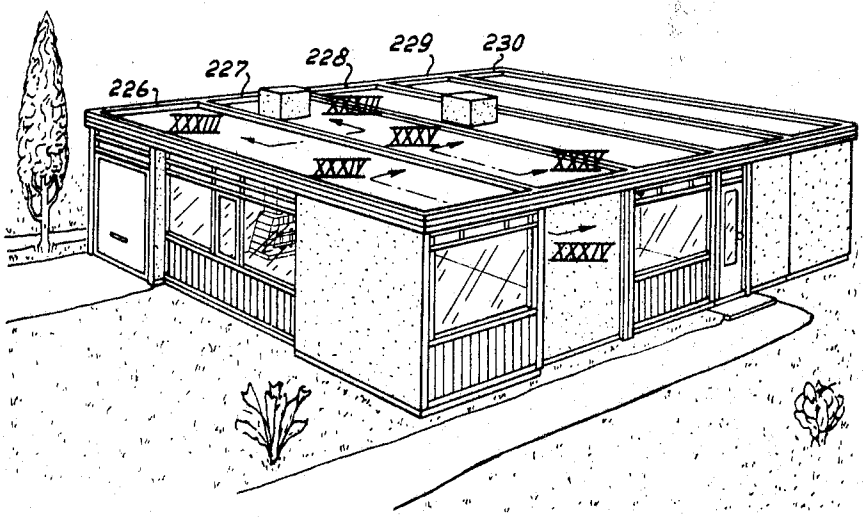


FIG. 31

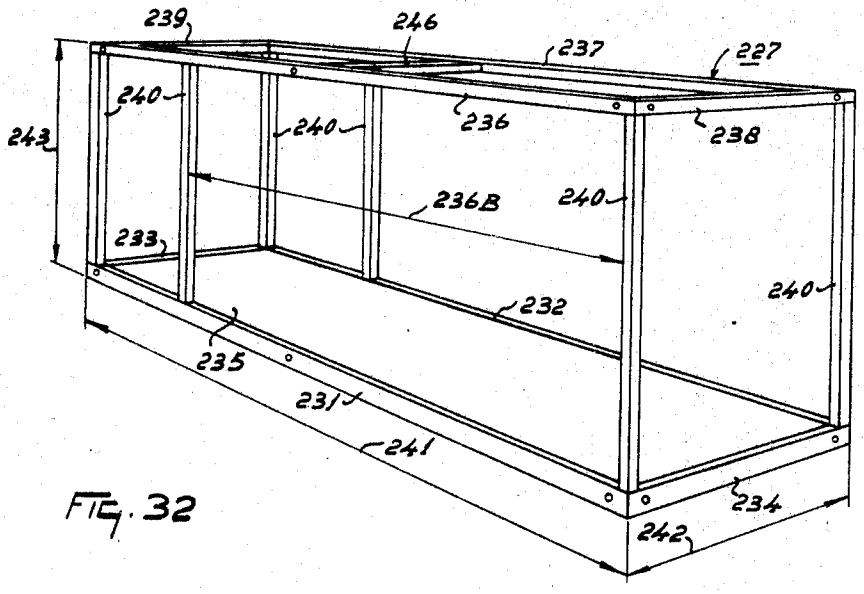


FIG. 32

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 13

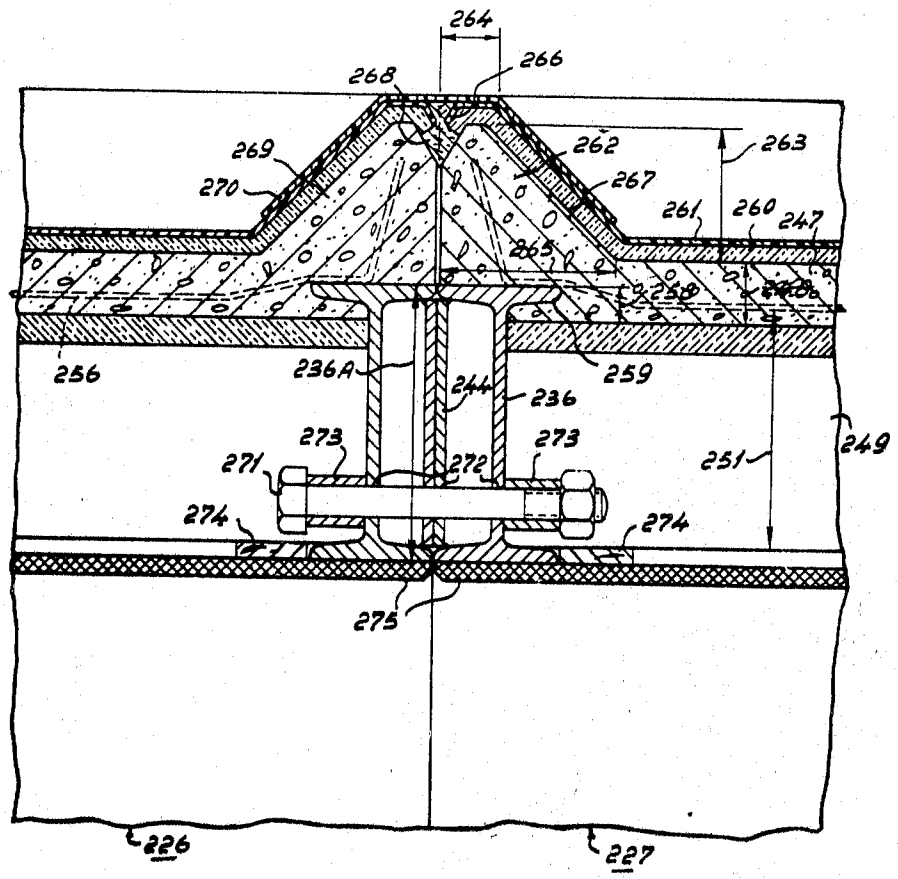


FIG. 33

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 14

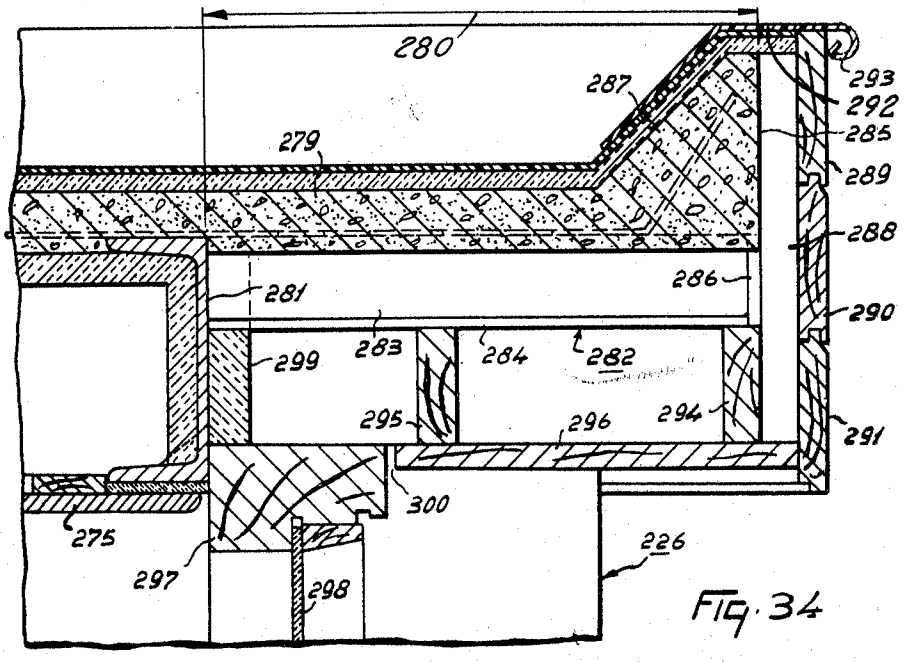
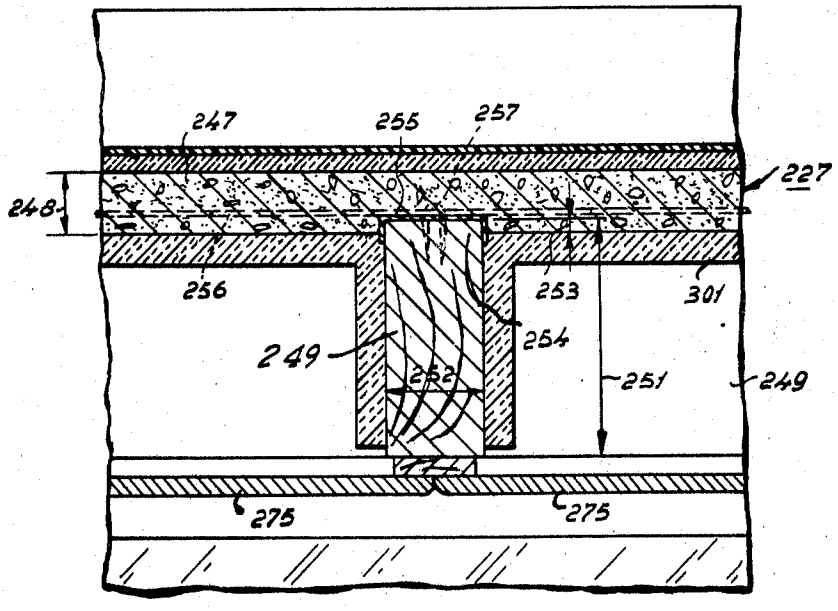


FIG. 34

FIG. 35



INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 15

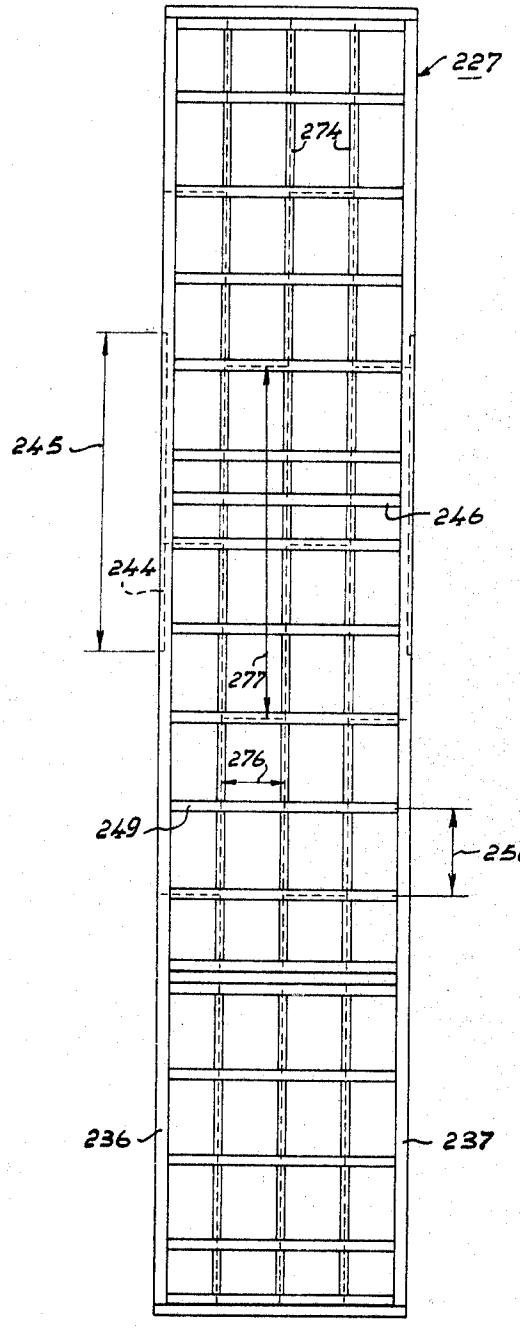


FIG. 36

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

Dec. 23, 1969 C. VAN DER LELY 3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Original Filed Sept. 22, 1964 16 Sheets-Sheet 16

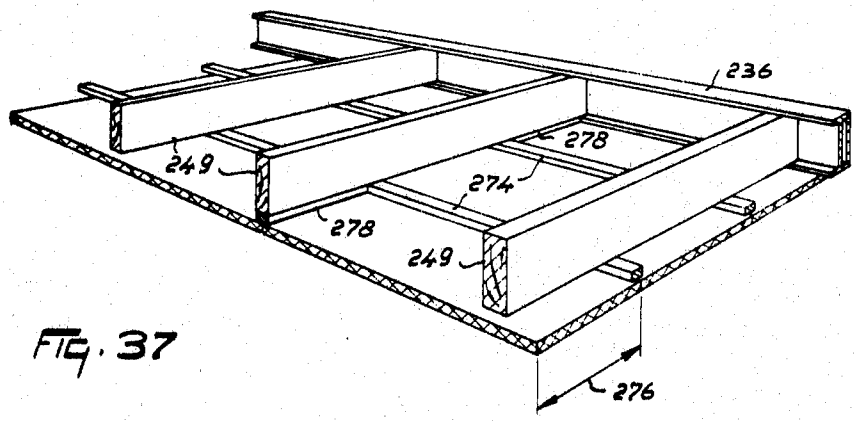


FIG. 37

INVENTOR.
CORNELIS VAN DER LELY
BY
Mason, Mason & Albright
Attorneys

United States Patent Office 3,484,999
Patented Dec. 23, 1969

3,484,999

PREFABRICATED SECTION OF A WALL, FLOOR OR ROOF

Cornelis van der Lely, 7 Bruschenrain, Zug, Switzerland

Continuation of application Ser. No. 398,234, Sept. 22, 1964. This application Aug. 14, 1968, Ser. No. 757,204
Claims priority, application Netherlands, Oct. 7, 1963, 298,902; Feb. 17, 1964, 6401391, 6401392, 6401393; Mar. 27, 1964, 6403369
Int. Cl. E04b 5/29; E04c 2/04; E04h 1/02
U.S. Cl. 52—79 29 Claims

ABSTRACT OF THE DISCLOSURE

Reinforced concrete slab for the floor or roof of a prefabricated building element, the slab being surrounded by frame of channel beams, the upper limb of the channel beams being embedded in the slab and having its upper face coplanar with the slab's face, a plurality of metal ribs partly embedded in the slab and connected to the reinforcing member in the slab and to the frame of channel beams.

SUMMARY OF THE INVENTION

This application is a continuation of application Ser. No. 398,234 filed Sept. 22, 1964.

The invention relates to a prefabricated section of a wall, floor or roof, comprising a slab of concrete or like material.

The invention has for its object, inter alia, to provide a prefabricated section of the kind mentioned above, the weight of which may be light as compared with its load capacity and which is readily transportable.

In accordance with the invention this can be achieved by providing the concrete slab on one side face with a plurality of ribs which are secured to the slab distributed thereover at a small distance from each other, said ribs being made independently of the concrete slab and being capable of withstanding stress or pressure or both. The ribs assume a large portion of the load capacity of the section and for such reasons are spaced closely together, e.g. separated by a maximum distance of 100 centimeters. An advantageous embodiment of the section according to the invention is obtained by embedding the ribs partly in the concrete slab.

The structure of the section is improved, in accordance with the invention, by providing the concrete slab with a connecting member and securing the connecting member to the ribs. In an advantageous embodiment of the invention the concrete slab has a thickness of between 2.5 and 6 centimeters.

According to a further aspect, the section according to the invention constitutes a wall, floor or roof of a box-shaped section enclosing a space which is provided with further walls, a roof and/or a floor. Because of the construction involved, the erection of a building is improved.

According to a still further aspect of the invention, the concrete slab is provided at its periphery with metal beams. By reason of the construction involved the section is made stronger and the beams provide protective means, especially protecting the edges of the section from damage.

An advantageous embodiment can be obtained when the ribs are made of metal.

According to a yet further aspect, the section according to the invention forms at least a part of a bottom or roof, whereby on the upper side the concrete slab is provided with a covering sheet of insulating material, which is secured to the concrete by casting the latter. The section can therefore be effectively employed in buildings in which the insulating material serves both for thermal insulation and for sound insulation.

The invention furthermore relates to a method of manufacturing a section according to the invention, in which the ribs are disposed on a jig, whereby the sides of the ribs to be connected with the concrete are disposed to face the jig and are subsequently cast while on the jig with the ribs being embedded in one side in the concrete.

A simple method consists in that, subsequent to casting of the concrete in its moist state, the insulating material which is to be disposed between the ribs is urged at least partly against concrete slab, so that it will stick to the concrete after the concrete has hardened.

The invention relates to a further house comprising only one story and erected by means of prefabricated box-shaped sections which are composed at least partly of concrete or like material and which each enclose at least part of a living space whereby, according to the invention, the house consists in principle of only two box-shaped sections which are parallelepiped-shaped and of which the walls, bottom and/or roof are made of concrete having a thickness of between 2 and 6 centimeters. In this manner a strong structure is obtained, whereas its weight may be small.

For a better understanding of the invention and to show how the same may be readily carried into effect, reference is made by way of example to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a prefabricated floor section, which is provided at its periphery with a metal rim.

FIG. 2 shows on an enlarged scale a detail of the section shown in FIG. 1, viewed in the direction of the arrows II—II.

FIG. 3 shows on enlarged scale an elevation of the element shown in FIG. 1 in the direction of the arrows III—III.

FIG. 4 shows a detail corresponding with that of FIG. 2 of a further embodiment of the invention.

FIG. 5 shows a detail of a section according to the invention, which corresponds with the detail of FIG. 3, but this section has an insulation on its bottom side.

FIG. 6 is a perspective view of part of a box-shaped section in which the floor section according to the invention is arranged.

FIG. 7 is a perspective view of a bungalow erected from box-shaped sections of the kind shown partly in FIG. 6.

FIG. 8 is a perspective view of a section according to the invention.

FIG. 9 shows on an enlarged scale a sectional view of a rim of the section of FIG. 8 taken on the line IX—IX.

FIG. 10 shows on an enlarged scale a sectional view of the section of FIG. 8 taken on the line X—X.

FIG. 11 is a sectional view corresponding with that of FIG. 10 with the ribs having, however, a shape differing from that of FIG. 10.

FIG. 12 shows on an enlarged scale a sectional view corresponding with that of FIG. 10, the ribs of the section having, however, a different shape.

FIG. 13 is a sectional view corresponding with that of FIG. 10 of a different embodiment of a section according to the invention.

FIG. 14 shows on an enlarged scale a sectional view corresponding with that of FIG. 10, the ribs having a different shape.

FIG. 15 is a sectional view of a different embodiment of a rim of the section according to the invention.

FIG. 16 is a perspective view of a garage according to the invention.

FIG. 17 is a horizontal sectional view of a side wall of the garage taken on the line XVII—XVII in FIG. 16.

FIG. 18 shows a plan of a house according to the invention.

FIG. 19 is a perspective view of the house of FIG. 18.

FIG. 20 is a sectional view taken on the line XX—XX in FIG. 18.

FIG. 21 is a sectional view taken on the line XXI—XXI in FIG. 18.

FIG. 22 shows, on an enlarged scale, the upper side of a section in a sectional view.

FIG. 23 shows on an enlarged scale part of the roof joints of the two sections, in the direction of the line XXIII—XXIII in FIG. 19.

FIG. 24 shows part of the roof arranged above a section, viewed in the direction of the line XXIV—XXIV in FIG. 19.

FIG. 25 shows on an enlarged scale a horizontal sectional view of part of a section taken on the line XXV—XXV in FIG. 19.

FIG. 26 shows on an enlarged scale a sectional view of the fastening of two sections to each other taken on the line XXVI—XXVI in FIG. 21.

FIG. 27 is a horizontal sectional view of a connecting part of the sections taken on the line XXVII—XXVII in FIG. 21.

FIG. 28 shows on an enlarged scale a sectional view of adjacent lower sides of the sections taken on the line XXVIII—XXVIII in FIG. 18.

FIG. 29 shows a plan of a house according to the invention the arrangement of which differs from that of FIG. 18.

FIG. 30 shows a plan of a further variant of the construction of the house according to the invention.

FIG. 31 is a perspective view of a bungalow erected from a plurality of sections manufactured according to the invention.

FIG. 32 is a perspective view of a frame of a section of the building shown in FIG. 31.

FIG. 33 shows on an enlarged scale a sectional view taken on the line XXXIII—XXXIII in FIG. 31 for the roof edges of two adjacent sections.

FIG. 34 shows on an enlarged scale a sectional view taken on the line XXXIV—XXXIV in FIG. 31 over part of the roof edge of a section.

FIG. 35 is a sectional view of part of the roof taken on the line XXXV—XXXV in FIG. 31.

FIG. 36 is a plan view of the structure of the ceiling, the roof covering being omitted.

FIG. 37 is a perspective view of part of the ceiling structure of FIG. 36.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1, 2 and 3 show a section comprising a slab **1** of foam concrete of a thickness designated by reference numeral **2**. The concrete slab **1** is provided on the bottom side with a number of metal ribs **3**, having a height designated by reference numeral **4**. The metal ribs **3** are made of thin sheet material of a thickness designated by reference numeral **5**. On the upper side each rib **3** is provided with a portion which extends perpendicularly thereto a distance designated by reference numeral **6** and on the bottom side with a further portion which similarly extends perpendicularly thereto a distance designated by reference numeral **7**. The upper side of the metal rib **3** is embedded in the concrete of the slab **1** over a distance designated by reference numeral **8**, which is approximately ½ of the height **4**. The metal ribs **3** are parallel to each other and are spaced apart from each other by a distance designated by reference numeral **9**. The thickness **2** of the concrete slab **1** is preferably less than 6 cms. and is in this embodiment 4 cms. The height **4** of the ribs **3** is 12 cms. and the thickness **5** is at the most 5 mms., and preferably 3 mms., as in the embodiment shown. The dimension of bent-over portion **6** is about 8 mms. while that of bent-over portion **7** is about 25 mms. The distance **9** between the metal ribs is less than 100 cms. and preferably about 50 cms.

The metal ribs **3** are provided with a layer **10** of anti-corrosive material. On the upper sides the metal ribs **3** have a connecting member **11**, which is embedded in the concrete slab **1** and is secured by spot welding to the upper side of the metal ribs. The connecting member **11** consists of a network or wires **12** extending in the longitudinal direction of the section and wires **13** extending transversely of the longitudinal direction, said wires having a thickness designated by reference numeral **15** of about 3 mms. The wires **12** and **13** are spaced apart from each other by distances designated by reference numeral **14** of about 30 cms. The upper sides **16** of the metal ribs **3** are not provided with anti-corrosive material in order to permit of welding the connecting member **11** thereto.

On the long sides the section is provided with rims **18** and **19**, which are located on opposite peripheral sides of the concrete slab. The rims **18** and **19** are formed by metal U-section beams of Np16. The metal ribs **3** are located between the rims **18** and **19** and extend at right angles thereto. The ends of the metal ribs **3** are welded by their lower sides to the lower limb **21** of the rims by spot-welding. The ends of the metal ribs extend over a distance designated by reference numeral **24** between the lower limb **21** and the upper limb **22** of each of the channel-section beams **18** and **19**, and are a distance as indicated by reference numeral **25** from the webs of the beams, which it is to be seen is approximately equal to the distance **24**.

The beams **18** and **19** have a length designated by reference numeral **20**, which is equal to the length of the section. The beams **18** and **19**, like the metal ribs **3**, are provided with a layer **26** of anti-corrosive materal. The beams **18** and **19** are provided with holes **27** through which connecting means can be taken in order to interconnect adjacent sections. The short sides of the section are provided with rims **28** and **29**, the ends of which are connected with the rims **18** and **19** so that the whole section is provided along its periphery with a metal rim. Also the rims **28** and **29** are formed by channel-section beams of Np16. The width as indicated by reference numeral **30** of the section is about 2.5 meters, and the length **20** is about 11.5 meters.

The structure as described above provides a solid light weight section. The section can be readily prefabricated and subsequently it can be easily transported, owing to the light weight and the solid structure, to the the site where the section has to form at least part of a floor. The section may be employed for all kinds of floors, for example in buildings as a floor or a roof or in bridges. In arranging the section in place, the rims **18** and **19** may be supported at one or more spots between the ends.

The section can be fabricated in a simple manner by arranging the metal strips parallel to each other and by interconnecting them by means of the connecting member. The ends of the metal ribs can be secured to the rims **18** and **19**, while the rims **28** and **29** may be secured in the same manner. The assembly can then be arranged on a jig so that the upper ends of the metal ribs are on the bottom side; then the concrete can be cast. The concrete can be cast on a vibrating table where the concrete is vibrated to obtain a compact structure.

Prior to casting of the concrete the various parts may be provided with anti-corrosive material. The rims **18** and **19** and the rims **28** and **29** may, for example, be first secured to each other with the ribs **3**, the assembly being then dipped in a bath of anti-corrosive material, for example "Innertol." Subsequently, the upper edges of the ribs can be partially cleaned in order to permit of securing the connecting member **11**. If desired, the connecting member **11** may be secured to the ribs **3**, the anti-corro-

sive material being applied, for example by dipping, to the member, ribs and edges.

FIG. 4 shows a detail of an embodiment corresponding in principle with the embodiment shown in FIGS. 1 to 3. However, the upper side of the concrete slab is provided here with an insulating layer **31**. The parts corresponding with those of the preceding figures are designated by the same reference numerals. The layer of insulating material **31** consists of a thin, resinous hardboard sheet, which is secured to the concrete by casting. The rims **31** extend over the limb **22** of the rim **19** and the corresponding limbs of the rims **18**, **28** and **29**. The coating of anti-corrosive material applied to the upper side of the limb **22** serves as a flexible layer promoting a satisfactory connection of the rims of the insulating material to the rims of the section.

In manufacturing a section as shown in FIG. 4, the layer of insulating material **31** may be disposed on the jig prior to casting the concrete slab, the frame of the rims and of the metal ribs being subsequently disposed on said jig and the concrete slab being then cast. The insulating layer **31** may serve simultaneously for heat insulation and sound insulation.

FIG. 5 shows an embodiment in which the section is provided with insulating material on the bottom side. The part corresponding with those of FIG. 3 are noted in FIG. 5 by identical reference numerals. The section shown in FIG. 5 is provided on the bottom side with strips **32** of insulating material, the width designated by reference numeral **33** being such as to be somewhat greater than the distance between the metal ribs **3**. The layer of insulating material **32** is formed by strips, the length of which is equal to the width **30** of the section. Each of the strips **32** bears with the upper side **34** of the bent-over edge **17** of the metal ribs, whereas the edge **35** is located beneath an edge **17** of a metal rib. The edges **17** are gripped by clamping members **36**, one limb **37** of which is located above the edge **17** and one limb **38** of which is located beneath such edge. The upper limb **37** bears on the edge **17** and the edge **34** of the sheet **32** is located above said limb. Between the edge **17** and the lower edge **38** of the clamping member **36** there is clamped the edge **35** of the strip of insulating material. The strips of insulating material **32** may be formed by soft board or other suitable cheap or light-weight material.

FIG. 6 shows part of a box-shaped section bounding at least part of one or more living rooms. The section shown in FIG. 6 is provided at the bottom with a floor section **39** of the structure shown in any of the preceding figures. Said section is built up by fastening vertical beams **40** to the rims **18**, **19**, **28** and **29**, the upper ends of said beams being secured to a rectangular frame of beams **41**, **42**, **43** and **44**. A section of the kind shown in FIG. 6 may be completely prefabricated and during the prefabrication process wall portions may be secured to the vertical beams **40**, and the lower portion **39**, and the beams **41**, **42**, **43** and **44**, said walls forming partitions between the various spaces of the building erected from box-shaped sections of the kind shown in this figure. In this figure, however, no partitions are shown.

FIG. 7 is a perspective view of a bungalow comprising box-shaped sections of the kind shown in FIG. 6. The bungalow comprises five sections **45**, **46**, **47**, **48** and **49**, the long sides of which are secured to each other.

The sections can be secured to each other by using the holes in the rims of the lower section **39**, for example the holes **27** and the corresponding holes in the frame of beams **41** and **44** and by inserting fastening bolts through said holes.

The embodiment shown in FIGS. 8, 9 and 10 is a plate-shaped section which is provided at the periphery with flange beams formed by metal channel-section beams. The section is rectangular and has a length designated by reference character **51B** and a width **51A** designated by reference character of about 10 meters and about 2.5 meters respectively. FIG. 8 shows two flange beams **52** and **53**. The section **51** comprises a slab **54** of foam concrete having a thickness as shown by reference character **55** of between 2.5 cms. and less than 6 cms.; in this embodiment it is about 4 cms. The slab **54** is supported from wooden, rectangular-section ribs **59**, which extend at right angles to the long sides of the section and are parallel to each other. As compared with the size of the section the ribs are arranged at a short distance from each other and in this embodiment at a distance indicated by dimension **60** of about 50 cms. Preferably the distance between the ribs is preferably will not exceed 100 cms. FIG. 10 shows two adjacent ribs, with part of the slab between these ribs is interrupted. However, with a view to the rigidity to be imparted by the ribs to the slab, the ribs will usually not be spaced apart from each other by more than 1 meter. The ribs **59** have a height as indicated by reference numeral **61** of about 15 cms. and a thickness of about 4 cms., designated by reference numeral **62**. The ribs **59** are embedded, as shown in the figures, with their upper parts over a distance as shown by reference numeral **61A** of about 2 cms. in the concrete of the slab **54**. The part of the ribs **59** embedded in the concrete is provided with a moisture-repelling layer **63**. Inside the slab **54** there is provided a connecting member **56**, which is formed by a network of circular-section metal wires **57** having a diameter, designated by reference numeral **58**, of about 3¼ mms. The width of mesh is preferably not more than 8 cms., and in this embodiment it is 5 x 5 cms. The connecting member is located centrally of the direction of thickness of the concrete slab **54**. The ribs **59** are arranged with their ends between the limbs of the flange beams arranged along the long sides of the section, for example between the limbs **64** and **65** of the beam **52** (see FIG. 9). The ends of the ribs **59** may, if desired, be secured to joists **66** provided between the limbs **64** and **65**. The limb **65** of the beam **52** and the corresponding limbs of the further flange beams are substantially completely embedded in the concrete. The connecting member **56** is connected with the flange beams for example by spot-welding and with the ribs **59** by means of cramps **59A**. The upper ends of the ribs are embedded in the slab **54** over more than half the thickness thereof. The slab **54** is provided on the side remote from the ribs with a layer **67** of insulating material, which consists, in the embodiments shown in FIGS. 8, 9 and 10, of a layer of cork. To the layer **67** are applied coatings **68**. The layer **67** has a thickness, designated by reference numeral **69**, of about 2 cms. Between the ribs **59** the lower side of the slab **54** is provided with a layer of insulating material **70**, for example of glass wool, which includes portions **71** to cover the sides of ribs **59**. On the lower side of the ribs **59** there are secured covering sheets **72**, composed of suitable material, for example, hardboard.

By using the structure according to the invention a section is obtained, the weight of which is light as compared with its load capacity. The section can be readily manufactured in the workshops. First a frame of two longitudinal beams **52** and two transverse beams is made, the ribs **59** being secured thereto. The network **56** is fastened to one side of the flange beams and of the ribs, after which the assembly is disposed with the network turned downwards in a jig, in which the slab **54** can be cast. Before casting the concrete, the metal parts and the sides of the ribs to be embedded in the concrete may be provided with an anti-corrosive layer. The various parts may, if desired, also be made of stainless material. On the bottom of the jig there may be disposed the cork layer **67**, the concrete being cast on said layer. The concrete will adhere satisfactorily to the cork layer **67** and the connecting member **56**, and the parts **61A** of the ribs **59** are thus embedded simply and effectively in the concrete. Before the concrete of the slab **54** has hardened, the insulating material **70** is applied to the still soft con-

crete, and is particularly pressed tight along the ribs against the concrete so that, when the concrete hardens, the layer **70** sticks to the concrete. The covering sheets **72** can be secured to the lower sides of the ribs remote from the connecting member **56** and subsequent to the removal from the jig, the covering layer **68** can be applied to the cork layer **67**.

A section of the kind described above may be used effectively, for example, as a roof portion, in which case the various layers of insulating material provide a satisfactory heat insulation and sound insulation. The sheets **72** may serve in this case as the ceiling of the space covered by the slab on the upper side. A section of the kind shown in FIGS. 8, 9 and 10 may be employed in a simple manner in box-shaped sections having several walls and bounding at least part of the space inside a building. In this case the beams at the peripheral edges, for example the beams **52** and **53**, may form, if desired, part of a metal skeleton of a prefabricated box-shaped section with said skeleton supporting walls, and with at least part of the roof and floor of a building formed from one or more prefabricated sections.

With the structure of the section comprising a large number of ribs evenly distributed over the slab and capable, in principle, of withstanding the major part of the forces exerted on the section, the slab **54** may have a small thickness. As a result, the concrete slab **54** can be loosened easily from the jig whereas the same will dry rapidly after casting and promptly be removed from the jig, so that the manufacturing process in the workshops takes little time and long drying periods of material and a great number of jigs are dispensed with.

FIG. 11 shows an embodiment in which the section is constructed in the same manner as in the preceding embodiment except that the ribs **59** are replaced by wooden ribs **73**, having a sectional area which is trapezoidal. Parts corresponding with those of FIGS. 8, 9 and 10 are designated by the same reference numerals as in the first embodiment. The ribs **73** have a height as shown by the dimension **73A** of about 12 cms. The small parallel sides embedded in the concrete have a width dimension **73B** of 25 mms. and the other larger side has a width dimension **73C** of 75 mms. Although this is not indicated in FIG. 11, a layer of insulating material may be applied to the lower side of the concrete slab, and to the lower side of the ribs **73** there may be applied a cover of hardboard or soft board. In certain cases it may be more advantageous to secure covering sheets to the wider lower sides of the ribs **73**.

FIG. 12 shows an embodiment in which the ribs **74**, which support the concrete slab, are made of metal having a thickness designated by reference numeral **75** of about 3 to 4 mms. The height of the metal ribs **74** is equal to the height of the ribs **73**. Parts shown in FIG. 12 which correspond with parts in the preceding embodiments are denoted by the same reference numerals. The metal ribs **74** are spaced apart from each other by distances corresponding with the distance **60** of FIG. 10. On one upper side of the ribs **74** there is provided a bent-over rim **76** and on the other side there is a further rim **77**. The rims **76** and **77** extend to different sides of the ribs and the rims **76** are completely embedded in the concrete. Also in the structure shown in FIG. 12 the bent-over rims **77** of the ribs **74** may be provided with covering sheets like the sheets **72** of FIG. 10, but this is not shown in the figure. The sections according to the invention may be used without covering sheets or ceiling sheets **72**. Before the concrete slab is cast, the metal ribs **74** may be provided with an anti-corrosive layer. Particularly with the use of metal ribs it may be important to have the layer of insulating material **70** prolonged along the ribs in order to avoid absorption and conduction of cold or heat through the ribs.

FIG. 13 shows an embodiment of a section consisting of a slab **78** of concrete, in which a reinforcement network **79** is provided, which may be formed in the same manner as the member **56** of FIG. 9. The slab **78**, like the concrete slabs in the preceding embodiments, has a thickness designated by reference numeral **80** of about 4 cms. The ribs on the slab **79** in this embodiment are formed by a strip **81** of channel-sectional area, having limbs **82** and **83**, the ends of which are embedded in the concrete slab **78**. The ends of the limbs **82** and **83** are provided with rims **84** and **85** bent-over towards the outer sides of the channel-section strip **82**. Between the limbs **82** and **83** and the web **86** of the channel-section strip **81**, the space **87** is filled out with concrete which is integral with the slab **78**. In this embodiment the slab **78** is provided on the side opposite the ribs **81** with ornamental strips **88**, which can be secured to the slab **78** during the casting operation. The ornamental strips or plates **88**, like the cork layer **67**, of the first embodiment, may be disposed on the bottom of the jig, the concrete being subsequently cast thereon. The ornamental plates **88** may be used particularly successfully when the sections form walls, in which case the ornamental plates **88** may constitute facade ornaments. The channel-section ribs **81** may be spaced apart from each other by the same distance as the ribs **59** (FIG. 10) or at a slightly larger distance. When the section is used for a wall, the ribs **81** may be arranged at a slightly larger distance from each other than in the case of using the section as a supporting floor. When used as a wall section, the height of the ribs need not be so great as in the case in which the section serves as a supporting floor. In FIG. 13 the ribs are lower than in the preceding embodiments and they have a height designated by reference character **81A** of about 4 cms., while the web **86** has a width of about 6 cms.

The embodiment shown in FIG. 14 corresponds with the embodiment shown in FIG. 11 and similar parts are designated by the same reference numerals. In the embodiment of FIG. 14, the ribs **73** are replaced by concrete ribs **89**, which are provided with reinforcement **90**. The ribs **89** are made independently of the slab **54** and are embedded therein when the slab **54** is cast. A water-repellent layer like the layer **63** (FIG. 10) around the rib **73** may be omitted when the concrete rib **89** is employed. The concrete ribs, like the ribs of the preceding embodiments, may be arranged on the peripheral edges of the section. The use of concrete ribs is particularly successful when the ribs are exposed to moisture, so that they may be of great importance when the section is used in a floor.

FIG. 15 shows a structure in which the peripheral edges of the section are formed in a manner differing from that shown in FIGS. 8 and 9. In the embodiment shown in FIG. 15, the peripheral edge is formed by a concrete rim **91**, which is stuck to the slab **54** during casting and which is integral herewith. The ribs **92** are cast in the concrete rim **91** and, as in the preceding embodiments they may be made of wood, metal or concrete. The peripheral rim **91** in the embodiment of FIG. 15 is provided with a portion **93** which projects above the upper side of the concrete slab **54** including the insulating layer **67** and the cover **68**. This construction may be advantageously used when the section forms a roof portion, in which case the rim **93** constitutes an upright roof edge, and the water is prevented from leaving the roof except at those places thereon where draining pipes or the like are provided. The construction shown in FIG. 15 may also be used in box-shaped sections, in which case the rim **91** may form the upper side of a side wall of the section as is shown in FIG. 15. The side wall **91** may then be built up in the manner shown in FIG. 13.

The building according to the FIGURES 16 and 17 forms a garage and is built up of only one prefabricated section which is supported from prefabricated foundation beams **102** and **103**. The prefabricated section **101** comprises a roof **104**, a floor **105** and side walls **106**, only one of which is shown in FIG. 16. The section furthermore

comprises a back wall **107** and a front wall **108**. The section has a width, designated by reference numeral **109**, of 2 to 3 meters and a length designated by reference numeral **120**, **110** of about 5.5 meters. The height, as indicated by reference numeral **111**, of the section amounts to about 2.5 meters.

The construction of the roof **104** is generally in accordance with FIG. 12 and the specific structure is not shown in detail. The roof **104** comprises a sheet-like portion **112** of foam concrete, on the lower side of which metal ribs **113** are provided. The concrete slab **112** has a thickness of more than 2.5 cms. and less than 6 cms. In this embodiment it is about 4 cms. The ribs **113** are arranged at distance designated by reference numeral **114** from each other, such distance being smaller than 100 cms. and in this embodiment about 50 cms.

The side walls **106** comprise each a sheet-like portion **115** (see FIG. 17) which is provided with a connecting member **116** forming a reinforcing network of metal wire having meshes of about 50 x 50 mms.

On the inner side of the slabs **115** of concrete there are provided channel-section ribs **117**. The ribs **117** have limbs **118**, the ends of which are embedded in the concrete slab **115** and are provided with bent-over rims **119**, which are secured to the connecting member **116**. The space **120** between the limbs **118** is filled out with concrete. The thickness as shown by reference numeral **121**, of the slab **115** is about 4 cms. and the channel-section ribs **117** have a height as indicated by reference numeral **122**, of about 4 cms. The slab **115** is provided with a plurality of channel-section ribs **117**, each of which extends vertically throughout the height of the wall **106**. The ribs **117** are spaced apart from each other by a distance, designated by reference numeral **123**, of about 80 cms. On the outer side of the slab **115** there is provided a facade decoration **124**, which is formed in this embodiment by plates forming rectangular faces on the outer side, having the appearance of masonry. The outer side of the ornament is flush with the outer side of the concrete slab **115** around it (FIG. 17). The concrete slabs **115** of the side walls **106** are integral with the concrete slab **112** of the roof.

The rear wall **107**, which comprises like the wall **106** a concrete slab having a reinforcement network is not described in detail. If desired, a facade decoration may also be applied to the outer side of the wall **107**. On the inner side there may also be provided one or more channel-section ribs. However, the rear wall may be formed simply by a thin reinforced concrete slab. The lower side **105** of the section consists of a concrete slab **125**, on the lower side of which ribs **126** are secured by casting. Ribs **126** extend throughout the width of the bottom **5** and are spaced at distances, designated by reference numeral **126**, of about 80 cms. from each other. The floor slab **105** is provided along its periphery with peripheral rims **127**, which bear, on the front side and on the rear side, on the prefabricated beams **102** and **103**.

On the front wall **108** there is provided a door **128**, which can be moved upwardly and is not shown in detail. The side walls **106** extend over short distances beyond the front wall **108** and the rear wall **107** so that chamfered edges for example the edges **129** and **130** are formed near the front side **108**, said edges being wider at the upper end than at the lower end, these edges joining a roof portion projecting beyond the front wall and the rear wall, respectively. On the lower side the edges **129** and **130** join the plane of the front wall **108**. At the corners near the front wall **108** and the edges **129** and **130** draining pipes **131** and **132** are arranged, the upper ends of which communicate with the upper side of roof slab **112**. The lower ends of the pipes **129** and **130** communicate with a draining pipe **133** which bears on the foot **134** of the foundation beam **102**. On the rear wall **107** draining pipes are provided which communicate with a waste pipe bearing on the foot of the foundation beam **103**.

The construction of a single section for the garage as described abve permits a rapid and easy prefabrication and a simple erection on the building site concerned. The structure of the roof and the walls described above, having thin, cast slabs provided with ribs, for example the ribs **113** and **117**, provides a light-weight assembly as compared with the load capacity, while at the same time a high rigidity of the construction is ensured and transport of the section is facilitated. Since the various sides of the section are made of thin concrete slab reinforced by ribs, the slabs will dry rapidly after casting, so that the manufacturing process takes only little time. The ribs on the side walls and the roof have such a shape and such dimensions that they are capable of withstanding the major part of the load.

Although in the embodiment shown the section according to the invention is employed for a garage, it may also be used for building a shed or other buildings, which may comprise more than one section according to the invention.

The building shown in FIGS. 18 to 28 and forming a dwelling house has only one story and comprises only two prefabricated sections **136** and **137**. Each of the sections comprises half of the space enclosed in the house. The section **136** has a width shown by dimension **138** of about 2.5 meters and a length, dimension **139**, of about 8 meters. The height **140** up to the lowermost edge of the roof is about 3 meters. On the lower side, the section **136** has a floor **141** (FIG. 20), which is reinforced on its long sides by means of ribs **142** and **143** and on its short sides by means of ribs **144**. The ribs **142**, **143** and **144** are arranged on the lower side and about the periphery of the floor.

The section **136** comprises a wall **145**, which constitutes an outer wall of the house, and walls **146** and **147**, which form half of the front facade and half of the back front, respectively, of the house. Parallel to the wall **145** there is provided a wall **148**, which extends over a distance, designated by reference numeral **149**, of about 4 meters and constitutes an inner wall of the house. The wall **146** is provided with an inwardly projecting rim **150**, which is in line with the wall **148**. The rim **150** has a width, as shown by dimension **151**, of about 15 cms. The section **136** has furthermore a wall **152**, which is parallel to the wall **145**, and walls **153** and **154** which are transverse to the wall **145**. The wall **152** has an opening **154** extending throughout the height of the section.

The section **136** comprises a kitchen **155**, a bathroom **156** and a bedroom **157** and at the side of the kitchen **155** and the bathroom **156** there is provided a space **158**. The bathroom **156** is provided with a shower-bath cell **159**, having a drainage **160**, with which communicates the kitchen drain pipe **161**. On the upper side, the section **136** has a ceiling **170**, along the edge of which there is provided a rim **194** in the plane of the rim **150**, said rim **194** extending between the rim **150** and the wall **148** and having the same shape as the rim **150**. The part of the section **136** comprising the floor **141**, the walls **145**, **146**, **147**, and **148** and the ceiling **170** and having the shape of a parallelipiped, is made of concrete.

On the upper side of the parallelipiped-shaped part of the section **136** there is provided a roof portion **162**, which consists of two rows of corrugated sheets **163** and **164**, which are parallel to the long sides of the section. The corrugated sheets are disposed on wooden girders **165**, **166** and **167**. The girders **165**, **166** and **167** are supported from cross girders **165A**, secured to supports **168** and **169**, which are secured to the ceiling **170** of the section **136**. The roof portion **162** is inclined and joins the ceiling **170** substantially completely above the wall **145**. During prefabrication, the wooden girders **165**, **166** and **167**, the supports **168** and **169** and the row of sheets **163**

are arranged in place on the section. The side sheets **164** are secured to the section at the building site.

At the edges between the walls **146** and **145** and between the walls **147** and **145** there are arranged oblique struts **172** and **173**, which have a width increasing from the lower ends to the upper ends and which point the roof portion **162**. The struts **172** and **173**, as is shown for the struts **172** in FIG. 25, are secured to the section **136** by means of bolts **174**. The bolt **174** for the struts **172** is taken through a hole **175** in the strut **172** and a hole **176** in the corner between the walls **145** and **146**. The nut **177** bears on a supporting plate **178** located in the corner between the walls **145** and **146**. Like the row of sheets **163**, the struts **172** and **173** are secured to the section at the building site.

The section **137** has mainly the same dimensions as the section **136** and comprises a wall **179**, which forms an outer wall of the house. The section **137** comprises furthermore walls **180** and **181**, which join the walls **146** and **147**, respectively. Between the walls **180** and **181** there is erected an inner wall **182**. The wall **180** is provided with a rim **183**, which joins the rim **150** of the section **136**, while the wall **181** has a rim **184**, which engages the wall **148**. The inner wall **182** has a rim **185**, which extends from the wall **182** towards the wall **181**. On the upper side the section has a ceiling portion **187**, above which a roof portion **188** is arranged. Rims **195** and **195A** are provided along the edge of the ceiling **187** joining the section **136**, the ends of said rims joining the edges **183**, **184** and **185** respectively. The section **137** has a floor **186**, which joins the floor **141** and which is provided, like the floor **141**, with ribs. The roof portion **188** is shaped in the same form as the roof portion **162** of the section **136**, so that further illustration is not required. At the ends of the wall **179** there are provided stiffening ribs **189** and **190**, which are constructed in the same way as the ribs **172** and **173** and are secured in the same manner to the section **137** as is shown in FIG. 25 for the strut **172**.

The prefabricated sections **136** and **137** are disposed side by side on the building site and secured to each other by bolts **191**, forming the fastening means shown in FIGS. 26 and 27. The bolts **191** are taken through holes in the rims **150**, **194**, **183**, **184**, **185**, **195** and **195A** and in the inner wall **148**, the sections being clamped against each other at said rims. The sections **136** and **137** are thus secured to each other along three vertical rims and a horizontal rim on the upper sides of the sections, so that a rigid connection between the sections is readily obtained. The engaging edges of the roof portions **162** and **188**, forming a gable roof for the house, are covered, subsequent to the assembly of the sections, by a strip **162A** which extends throughout the length of the ridge of the roof. The section **137** comprises a space **192** and a space **193**, the latter forming a bedroom and the former a living room, which is integral with the space **158** of the section **136**.

The sections **136** and **137** are arranged on wooden or concrete foundation strips, which are prefabricated and disposed on the ground. The ribs on the long sides of the sections bear on foundation strips **196**, **197** and **198**. The central strip **197** supports the two engaging ribs on the lower sides of the floor portions **141** and **186**. The cross ribs **144** at the periphery of the floor may also be supported from foundation strips. However, these ribs **144** may also join the ground where the strips **196**, **197** and **198** are arranged so that ribs beneath the peripheral sides of the floor nevertheless close completely the space below the floor.

The sections have thin concrete walls, the thickness lying between 2 cms. and 6 cms. The thickness of the walls is preferably about 4 cms. The walls are reinforced by ribs which are arranged, as shown in FIG. 18, on the inner sides of the walls of the sections. If desired, they may be provided on the outer side of the section.

Above the ceiling **170** there is arranged a tank **199** which may be employed as a buffer vessel for water between the inlet of the water main to the house and the taps in the house.

Doors and windows are provided in the vertical walls of the sections, which is shown in FIG. 19. The windows are provided with frames embedded in the walls. If desired, gratings may be embedded in the concrete of the section walls to guard the windows.

The space above the ceiling portions **170** and **187** in the sections **136** and **137**, respectively, provides a satisfactory insulation. On the front side and on the rear side said space is closed by boards **200**, shown in FIGS. 21 and 19. The boards are arranged at a short distance from each other, so that chinks **201** are left between the boards. The chinks **201** permit a satisfactory ventilation of the space between the ceilings **170** and **187** and the roof portions **162** and **188**. Although the boards **200** in the embodiment shown are flush with the forefront and the backfront of the house, they may be arranged near the ends of the roof edges projecting beyond the fronts, so that they are spaced apart from the faces of the forefront and backfront. In this construction the space above the ceilings is readily accessible so that this space may, if desired be used as storage space.

During the manufacture the parallelepiped-shaped parts of the sections are cast in one piece. The walls may be finished by applying a layer of paint to the concrete. The houses according to the invention may be employed effectively in tropical or subtropical countries. They may, moreover, serve as week-end houses. If desired, the walls may be provided on the inner side with suitable hangings for embellishment.

During the prefabrication process of the sections the windows, doors and other fittings used in a house, for example ducts and cupboards are disposed in place, so that the sections can be readily assembled on the building site.

The arrangement of the houses shown in FIG. 28 may be modified. FIGS. 29 and 30 thus show plans of different dispositions. Also in this case the house comprises two sections, the various walls of which are arranged in accordance with the desired dispositions. The house shown in FIG. 29 comprises two sections **202** and **203**, the former comprising a bedroom **204**, a living room **205** and an adjacent kitchen **206**. The section **203** comprises a bedroom **207**, a bedroom **208** and between them a washing space **209** and a showerbath **210**. The section **203** comprises furthermore a part **211**, which joins the room **205**. The house of FIG. 30 comprises two interengaging sections **212** and **213**, the former comprising a living room **214** and a porch **215** and the section **213** comprises bedrooms **216** and **217**, a showerbath cell **218** with a toilet space **219** and a kitchen **220**. The kitchen **220** communicates through an opening **221** with the room **214**. Although this is not shown in FIGS. 29 and 30, the walls of the sections may be stiffened by means of ribs. Also in the last-mentioned embodiments only one of the two sections of the house is provided with water conduits and outlet ducts in order to facilitate the building operations.

FIG. 31 shows a bungalow which is principally the same as the bungalow shown in FIG. 7. The bungalow according to FIG. 31 comprises also five prefabricated sections **226**, **227**, **228**, **229** and **230**. Each of the sections is shaped in the form of a parallelepiped and comprises the skeleton of metal profile beams, to which walls are attached, which form part of the walls, the floor and the roof of the bungalow.

The frame of the section **227** is shown in FIG. 32 and is somewhat different than that according to FIG. 6. The beams on the long sides are formed by I-section beams, whereas on the short sides the beams are formed by channel-section beams. On the lower side of the section, this skeleton has a rectangular frame of two long beams **231** and **232** and two short beams **233** and **234**. A floor **235** is arranged within the periphery of the beams **231**, **232**, **233** and **234**. On the upper side the

skeleton comprises a rectangular frame consisting of two long beams **236** and **237** and two short beams **238** and **239**. The rectangular frames formed by the beams **231**, **232**, **233** and **234** and the beams **236**, **237**, **238** and **239** are interconnected by vertical beams **240**. The sections have a length, designated by reference numeral **241**, and a width, reference numeral **242**, which amount in this embodiment to about 11 meters and about 2.5 meters, respectively. The height, dimension **243**, is about 2.5 meters. The beam **236** is freely supporting over a length of about 8.5 meters.

As is shown in FIG. 33, the beam **236** is an I-section beam having a height, shown by reference character **236A**, of 18 cms. In order to stiffen the beam **236**, a supporting plate **244** (FIG. 36) is arranged at the center of its free span indicated by reference character **236B**, said plate extending over a length shown by reference numeral **245**, of about 2 meters. At the centers of the length **236B** the beam **236** is supported in a horizontal direction by a supporting beam **246**, which extends between the beam **236** and the beam **237**, parallel to the beams **238** and **239**.

Each of the sections **226**, **227**, **228**, **229** and **230** is provided on the upper side with a roof portion to form the roof of the bungalow. The roof portions of each of these sections are, in principle, of the same shape, which will be described in detail for the section **227**. The roof portion of the section **227** comprises a concrete slab **247** of foam concrete, having a thickness, dimension **248**, of about 4 cms. (FIGS. 33 and 35). The concrete slab **247** is provided on its lower side with wooden ribs **249**, which extend parallel to the beams **238** and **239** between the beams **236** and **237** and are secured at their ends to the beams **236** and **237**. The wooden ribs **249** are spaced apart from each other by a distance, designated by reference numeral **250**, of about 75 cms. (FIG. 36). The wooden ribs **249** have a height, dimension **251** in FIGS. 33 and 35, of about 15 cms. and a width, dimension **252** in FIG. 35, of about 6.5 cms. The upper sides **254** of the ribs **249** are embedded over a distance, as designated by reference numeral **253**, of at the most half the thickness of the slab in the concrete. In this embodiment the ribs are embedded over a length of about 1 cm. in the concrete slab. The upper sides **254** of the ribs **249** embedded in the concrete slab are provided with a waterproof coating **255**. Inside the concrete slab **247** there is arranged a connecting member formed by a reinforcement network **256**, which is fastened to the upper sides of the ribs **249** with the aid of cramps **257**. The network **256**, which is not shown in detail, consists of round metal wire of a diameter of about 3.25 mms., the meshes being about 50 x 50 mms. The beams **236** and **237** are embedded in the concrete slab **247** over a distance, designated by reference numeral **258**, of about 2.5 cms., so that the limb **259** of the upper flange of the I-section beam **236** is completely surrounded by the material of the concrete slab **247**. The reinforcement network **256** is slightly bent-over upwardly near the beam **236** and secured to the upper side of the beam **236** for example by spot-welding. To the lower side of the concrete slab **247**, between the ribs **249**, there is applied a layer of insulating material **301**. On the upper side the concrete slab **247** is provided with a layer **260**, which may be of resilient, insulating material, having a thickness of about 1 cm. In this embodiment the layer **260** is made of cork. The layer **260** is covered by a coating **261** of waterproof material.

Throughout the periphery the roof portion of the section **227** is provided with upright rims. This is shown by the rim **262** on one side of the section in FIG. 33. The rim **262** extends over a height, dimension **263** in FIGURE 33, of about 9 cms. above the concrete slab **247**. The rim **262** has a right trapezoidal sectional area and the short parallel side, indicated by dimension **264**, is located on the upper side and the long base, indicated by reference numeral **265**, is located on the concrete slab **247**. The side which is at right angles to the base is located on the outer side of the section. The side **265** has a length of about 12 cms. and the side **264** has a length of about 4 cms. On the upper side and on the edge of the section, the rim **262** is provided with a bevelled edge **266**. The layers **260** and **261** extend along the slanting side **267** of the rim **262** beyond the side **264** and along part of the slanting rim **266**. The rim **269** of the roof portion joining the rim **262** and provided on the upper side of the section **226**, is shaped in the same manner as the rim **262**, so that a further description may be omitted. Between the slanting rim **266** and the corresponding slanting side of the section **226** there is left a V-shaped opening which is filled with a watertight substance **268** after the sections **226** and **227** are joined. After the material **268** has been applied, a coating **270** is stuck across the rim **267** and the rim **269**, said strip extending beyond the slanting sides of the rims **267** and **269**.

The sections are secured to each other by a few bolts **271**, which are taken through holes **272** in the lower side of the beam **236** and corresponding holes in the beam of the section **226** joining the beam **236**. Between the head and the nut of the bolts **271** and the beams there are arranged spacing sleeves **273**.

To the lower sides of the ribs **249** are secured laths **274**, which extend parallel to the beams **236** and **237** and at right angles to the longitudinal direction of the ribs **249**. To the lower sides of the laths **274** are secured coating sheets **275**, which constitute ceiling sheets of soft board. The sheets **275** have a width, dimension **276** (FIGS. 36 and 37), which is equal to the central distance between two adjacent laths **274**. The sheets **275** have a length, dimension **277** which is several times the distance between two adjacent ribs **249**. In the embodiment shown, the sheets have a length of about 3 meters, which is equal to four times the distance between two adjacent ribs **249**. Between the laths **274**, to the lower sides of the ribs **249** there are secured supporting laths **278** (FIG. 37); to which are secured the ends of the sheets **275**. The supporting laths **278** are only disposed at the place of the ends of the sheets **275**.

At the place where the portions of the sections constitute the roof edge of the bungalow the roof portions extend beyond the parallelepiped formed by the frame beams of the sections and beyond the outer walls of the bungalow. FIG. 34 shows the edge of the roof portion of the section **226**, which extends beyond an outer wall of the bungalow over a distance, indicated by reference numeral **280**, of about 40 cms. The roof portion provided on the upper side of the section **226** comprises a concrete slab **279**, which extends over a distance **280** beyond the frame beam **281** of the section **226**. The concrete slab **279** is supported beyond the beam **281** by ribs **282**, which are formed by angle-section irons. One limb **283** of each of the ribs **282** extends vertically and one limb **284** horizontally, the latter forming the lower side of the rib **282**. The ribs **282** are welded to the outer side of the metal channel-section beam **281**. The free ends of the ribs **282** are interconnected by means of a strip **286**, the outer side of which is flush with the outer edge **285** of the concrete slab **279**. The ribs **282** extend at right angles to the beam **281** and are spaced apart by distances of about 75 cms. from each other, said distances corresponding with the distances between the adjacent wooden ribs **249**. The peripheral edge **287**, like the edge **262** (FIG. 33) has a trapezoidal shape. Along the strip **286** and along the outer edge **285** vertical wooden beams **288** are arranged at a distance from each other, and boards **289**, **290** and **291** are secured to said beams. The boards **289**, **290** and **291** constitute an ornamental rim along the outer edge of the roof of the bungalow. A covering rim **292** is applied to the edge **287** and the upper board **289**, said cover being provided with a bead rim **293** extending on the outer side of the board **289**. To the lower side of the ribs **282**, beams **294** and **295** are

secured in parallel position relative to the beam **281**, the beam **294** being flush with the strip **286** and the edge **285**. To the lower sides of the beams **294** and **295** is secured a closing plate **296**. The plate **296** engages on one side the board **291** and extends on the other side up to the proximity of a window frame **297**, which joins the beam **281** and comprises a pane **298**. Above the window frame **297** a strip **299** of insulating material is applied to the beam **281**. Where the section has a closed wall portion at the place of the window frame of another section the board **296** extends up to the wall. Between the inner side of the board **296** and the window frame **297** a narrow gap **300** is left free.

By forming a roof portion on the upper side of a section in the manner described above the structure has a light weight and can be readily arranged on the sections during the prefabrication process. The roof portion can be arranged in place by first manufacturing the rectangular upper frame of the beams **236**, **237**, **238** and **239**, after which the wooden ribs **249** are secured thereto. Then the network **256** can be disposed, after which the frame with the ribs and the network is disposed upside down on a jig and the concrete can be cast for the slab **247**. The lower frame of the beams **231**, **232**, **233** and **234** with the floor **235**, forming part of the floor of the bungalow may be formed in the same way as the upper frame with the roof portion. The ribs may, if desired, be made of different material. After the upper and lower frames are ready, they can be secured to each other by means of the vertical beams **240**.

By providing the ceiling sheets **275** on the lower side of the ribs **249** the ceiling is obtained in a simple manner. By providing a length of the sheets **275** which exceeds the distance between two ribs **249**, it is only necessary to provide at the ends of the sheets **275** supporting beams **278** between the laths **274**, so that the number of supporting laths **278** to be provided with respect to the whole ceiling can be small. The space between the sheets **275** and the concrete slab **247** may serve satisfactorily as an insulating space. The layer of insulating material **301** may be urged against the concrete slab **247**, shortly after casting, when it has not yet hardened, so that the insulating material **301** will stick to the concrete during the hardening process. The insulating material **301** needs therefore not be secured separately to various parts.

By providing the elevated rims along the edges of the roof portions of the bungalow on the upper side of each section, a satisfactory closure between the various sections is obtained. The rims constitute furthermore cup-shaped roof portions which ensure a satisfactory drainage of rain water.

The projecting structure of the edge of the roof of the bungalow is obtained in a simple manner in the embodiment described. The opening **300** between the plate **296** and the window frame **297** may serve simply as a circulating opening for air circulation in the space below the sheets **279** and above the plate **296**.

Although this is not shown in the drawings, the wall portions of the sections forming inner walls or outer walls of the bungalow may be built up from thin-walled concrete slabs having a great number of ribs.

I claim:

1. A floor of a prefabricated building element which includes a wall portion, ceiling portion and a framework, said floor comprising a slab of concrete-like material, a frame of beams which comprises the lower supporting portion of said framework provided at the periphery of said slab, said slab being enclosed over its whole thickness by said frame of beams and the upper face of the slab being coplanar with the upper side of said frame, parallel ribs being connected between opposing of said beams of said frame, the upper side of said ribs being embedded in said slab, the lower sides of said beams and said ribs extending lower than the lower side of said slab, a reinforcing member being fully embedded in said slab, said reinforcing member resting against and connected to the upper sides of said ribs.

2. The structure of claim **1** wherein said ceiling comprises an upper portion of said framework, said upper portion comprising metal beams having a lower horizontal extension, parallel wooden ribs disposed across said portion supported by said extension, ceiling members secured to said wooden ribs.

3. Structure as claimed in claim **1**, wherein said ribs extend parallel to each other and are spaced apart by a maximum distance of about 100 cm.

4. Structure as claimed in claim **1** wherein said slab has a thickness which exceeds 2.5 cms. and is smaller than 6 cms.

5. Structure as claimed in claim **4**, wherein said connecting member is formed by a reinforcing network having meshes of about 5 x 5 cms. and made of metal wire having a diameter of about 3 mms.

6. Structure as claimed in claim **1**, wherein said slab is composed of foam concrete.

7. Structure as claimed in claim **1**, wherein said slab has a width of at least 120 cms. and at the most 300 cms., whereas said ribs extend in the direction of the width of said slab.

8. Structure as claimed in claim **1**, wherein said ribs are composed of metal.

9. Structure as claimed in claim **8**, wherein said metal ribs have a thickness of not more than 5 mms.

10. Structure as claimed in claim **8**, wherein said ribs each include bent-over edges, one edge remote from said slab and the other edge embedded therein, the edge remote from said slab being about twice as wide as the edge embedded in said slab.

11. Structure as claimed in claim **10**, wherein on the side remote from said slab said ribs are provided with a layer of insulating material, said insulating material being formed by strips extending between said ribs, detachable fastening members securing said insulating material at least on one side to said ribs, said detachable fastening members formed by clamps gripping around the bent-over edges of said ribs whereby one clamp urges one side of a said strip of insulating material to the lower side of the bent-over edge of a rib, and the other side of an adjacent strip of insulating material lies freely above the bent-over edge of said latter rib.

12. In a prefabricated building element, a structural component comprising a concrete slab which is substantially coplanar, steel reinforcement in said slab, a plurality of ribs partly embedded in said slab and connected to said reinforcement, said ribs extending normally from said slab, a frame around the periphery of said slab including a metal beam connected near the edge of said slab, said beam including an intermediate part which is disposed normally to said slab and said ribs, and upper and lower limbs extending normally in the same direction from said intermediate portion, the upper of said limbs embedded in said slab, the ends of said ribs received between said limbs and affixed to the lower of said limbs.

13. Structure in accordance with claim **12**, wherein an insulating material is firmly attached to said slab between said ribs.

14. Structure in accordance with claim **12**, wherein a layer of further insulating material is firmly attached to the side of said slab opposite said ribs.

15. Structure in accordance with claim **12**, wherein a portion of said slab overlaps said beam, said reinforcement joining the upper limit of said beam, further ribs firmly attached to said beam and extending normally therefrom under said overlapping portion.

16. Structure in accordance with claim **12**, wherein said ribs are composed of wood.

17. Structure in accordance with claim **12**, wherein said slab forms a wall, a facade decoration being included in the outer side of said wall, the material of the side wall being cast on said decoration.

18. Structure in accordance with claim 12, wherein said facade decoration is formed by a plurality of plates having the appearance of masonry.

19. Structure in accordance with claim 12, wherein said ribs are U-shaped with the free ends of the limbs thereof embedded in said slab, the space inside said ribs being filled out with the material of said slab.

20. In a prefabricated building element, a structural roof component comprising a concrete slab, steel reinforcement in said slab, a plurality of ribs partly embedded in said slab and connected to said reinforcement, said ribs extending normally from said slab, a metal frame around the periphery of said slab which includes a metal beam connecting near the edge of said slab, said beam including an intermediate vertical part which is disposed normally to said slab and said ribs, and upper and lower horizontal limbs extending normally in the same direction from said intermediate portion, the upper of said limbs embedded in said slab and contacting a portion of said reinforcement, said ribs received between the upper and lower of said limbs, said reinforcement portion extending upwardly from said upper limb, a portion of said slab at the periphery thereof receiving said reinforcement portion and being substantially trapezoidal in cross section.

21. Structure in accordance with claim 20, wherein two of said slabs are joined with said trapezoidal-shaped portions in abutting relationship, a covering layer bridging said portions.

22. Structure in accordance with claim 20, wherein said slabs are of an elongated rectangular configuration, said ribs being parallel to the shorter sides thereof.

23. A prefabricated building element of parallelepiped configuration which comprises an elongated framework of metal beams disposed at the edges of the element and including a wall, ceiling and floor between said beams, said floor comprising a single slab of cast concrete-like material, the lower of said metal beams comprising a frame of beams around the edges of said slab, the face of said slab being coplanar and contiguous with the upper face of said frame, the periphery of said slab being enclosed over its entire thickness by said frame, said frame comprising a lower horizontal portion extending inwardly relative to said periphery, a reinforcing member in said slab, a plurality of ribs in part embedded in and extending vertically out of said slab to said lower horizontal portion, said ribs firmly attached to said reinforcing member and to said lower horizontal portion, whereby in the absence of said material and with said frame in an inverse position said reinforcing member is adapted to depend from said horizontal portion through said ribs, and in the presence of said material with said frame in an upright position said ribs are adapted to underbrace said slab against forces of tension and compression.

24. An element in accordance with claim 23, wherein said ribs include a vertical part and a horizontal part, said horizontal part bearing against said lower horizontal portion of said frame.

25. An element in accordance with claim 24, wherein said ribs include a further horizontal part bearing against said reinforcing member.

26. An element in accordance with claim 23, wherein said frame comprises said lower horizontal portion, an upper horizontal portion and a vertical portion joining the aforesaid horizontal portions, said upper portion including said face.

27. An element in accordance with claim 26, wherein said rib includes a vertical part and a horizontal part, said horizontal part bearing against lower horizontal portion of said frame.

28. An element in accordance with claim 27, wherein the ends of said ribs are spaced from said vertical portions of said frame.

29. An element in accordance with claim 23, wherein said material is less than about 6 cms. in thickness.

References Cited

UNITED STATES PATENTS

765,009	7/1904	Hinchman	52—340
1,245,395	11/1917	Smulski	52—334 X
1,360,979	11/1920	Stewart	52—341 X
1,997,809	4/1935	Cole	52—601 X
2,074,721	3/1937	Erdmann	52—236 X
2,167,208	7/1939	Hilpert	52—321 X
2,235,001	3/1941	Allen	52—601 X
2,703,003	3/1955	Ruppel	52—601
2,934,934	5/1960	Berliner	52—601
2,969,619	1/1961	Didrick	52—601
3,245,185	4/1966	Rowe	52—601 X

FOREIGN PATENTS

604,487	7/1948	Great Britain.

ALFRED C. PERHAM, Primary Examiner

U.S. Cl. X.R.

52—405, 601