May 6, 1969 C. VAN DER LELY ETAL 3,442,056

PREFABRICATED BUILDING SECTION WITH WALL, FLOOR, AND CEILING COMPONENTS CAST IN PROPOFILED EDGE BEAM

Filed March 2, 1966 Sheet 1 of 4

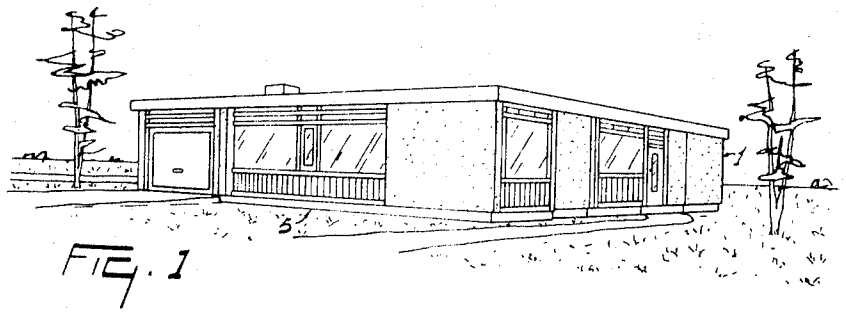
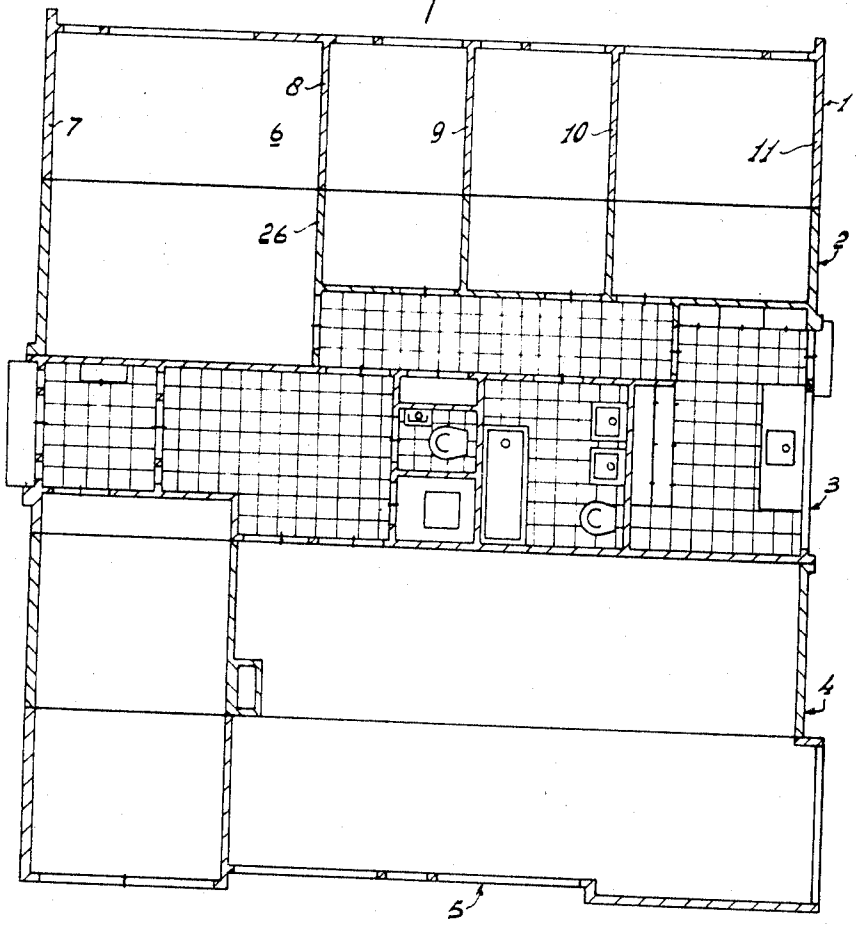


FIG. 1

FIG. 2



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Sheet 2 of 4

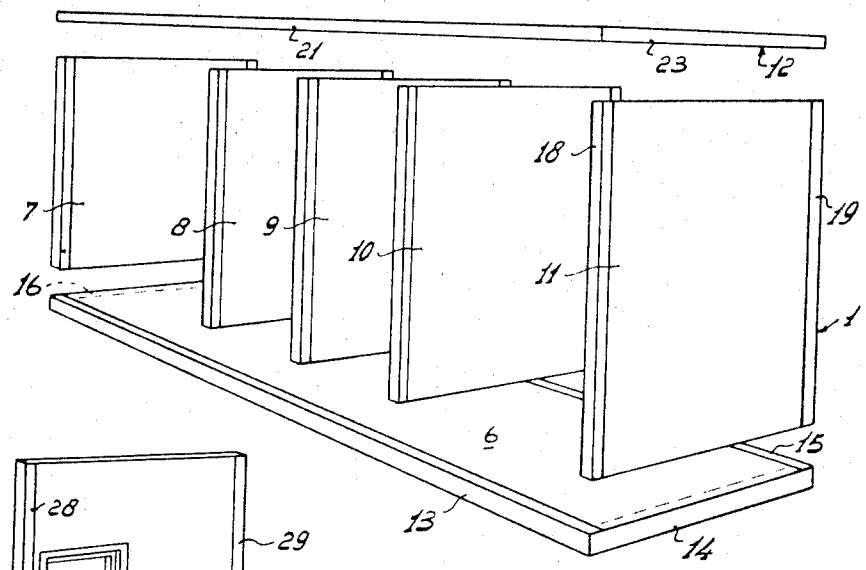

FIG. 3

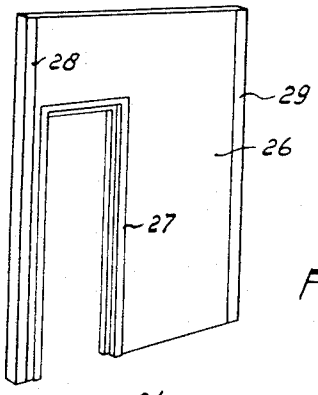

FIG. 5

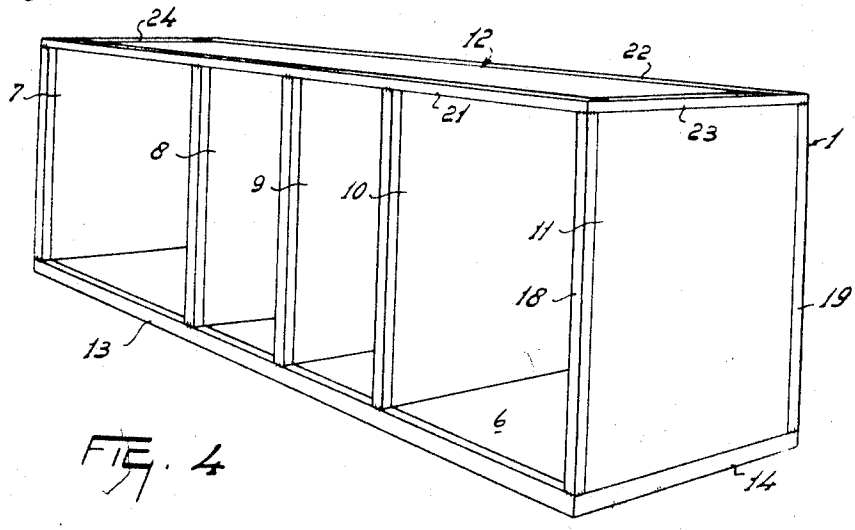

FIG. 4

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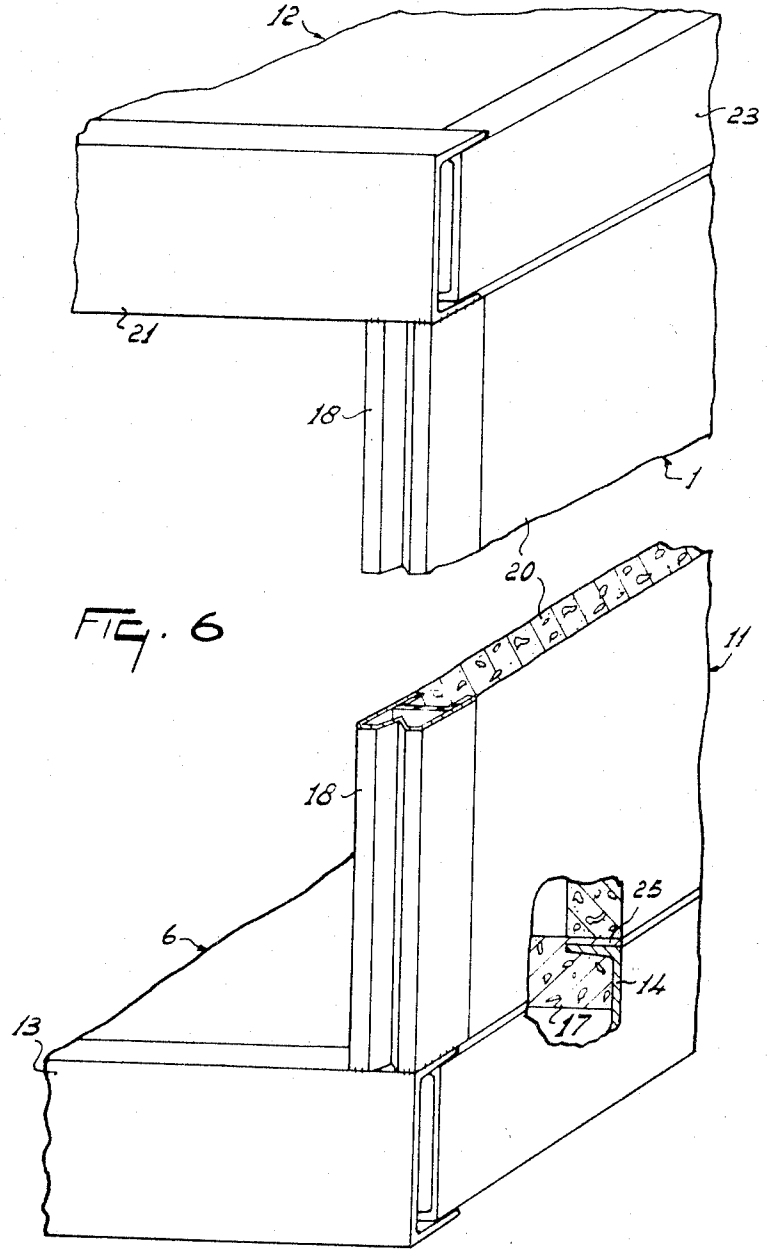

FIG. 6

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PREFABRICATED BUILDING SECTION WITH WALL, FLOOR, AND CEILING COMPONENTS CAST IN PROFILED EDGE BEAMS

Filed March 2, 1966 Sheet 4 of 4

FIG. 7

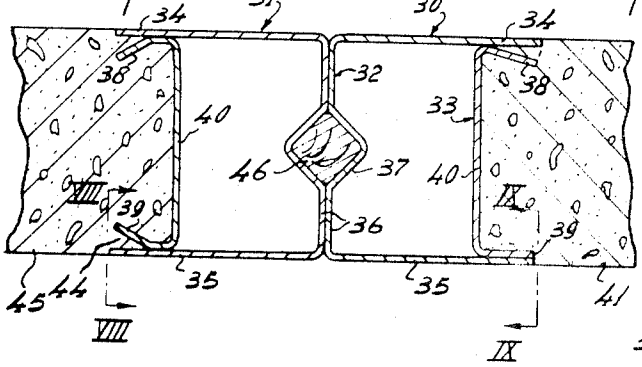

FIG. 8

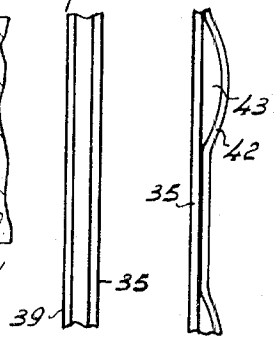

FIG. 9

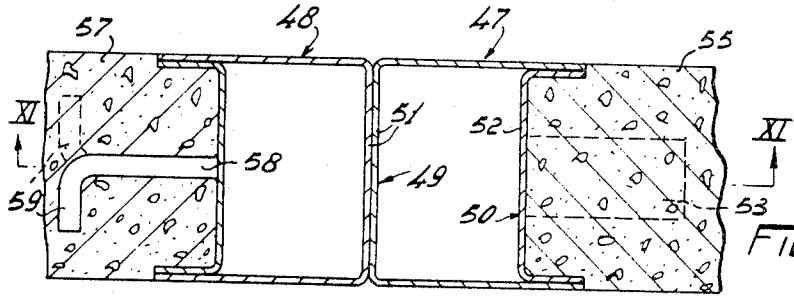

FIG. 10

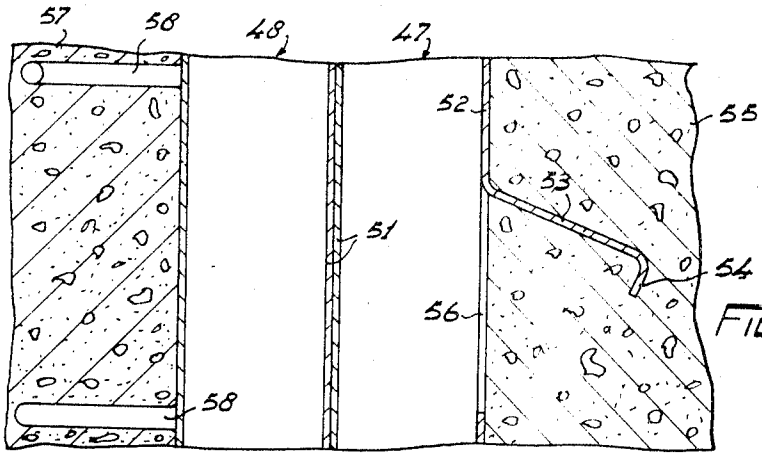

FIG. 11

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3,442,056

PREFABRICATED BUILDING SECTION WITH WALL, FLOOR AND CEILING COMPONENTS CAST IN PROFILED EDGE BEAMS

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Int. Cl. E04h 1/12, 9/06
U.S. Cl. 52—79
8 Claims

ABSTRACT OF THE DISCLOSURE

A prefabricated building unit wherein the wall, floor and ceiling components have profiled metal beam frames such as U-beam frames and a castable material such as concrete is cast in the frames. The components are welded or otherwise secured together to form a parallelepiped unit. Deformable material may be used to fill open spaces or on the floor component when the components are secured together. Frame beams are U-shaped with a smaller U-shaped beam therein, the legs of each terminating in the same area with continuous or interrupted spaces therebetween adapted to receive and hold the cast material. Inward extensions from the frame beams extend into the cast material.

Summary of the invention

The invention relates to a prefabricated section for a building, the section having a wall portion, a floor portion and a ceiling portion.

The invention has for its object to provide a strong section that can be manufactured within a short time and at low costs It is intended for a building which can be erected in a simple manner by one or more of these sections.

According to the invention, there is provided a prefabricated section for a building, the section having a wall portion, a floor portion and a ceiling portion, one or more walls of the section being constituted by profiled metal beams between which material is cast, said profiled metal beams being secured to further profiled metal beams arranged in or on the floor or the ceiling, or both, of the section.

Brief description of the drawing

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, in which:

FIGURE 1 is a perspective view of a building forming a bungalow comprising prefabricated sections according to the invention,

FIGURE 2 is the plan of the bungalow shown in FIGURE 1,

FIGURE 3 is an expanded view showing diagrammatically the parts which will be assembled to form a section of the bungalow shown in FIGURE 1,

FIGURE 4 is a perspective view of the parts shown in FIGURE 3 joined to form the section,

FIGURE 5 shows a wall of a section provided with a door frame,

FIGURE 6 is a fragmentary and broken perspective view in enlarged scale of a detail of the section shown in FIGURE 4,

FIGURE 7 is a horizontal section showing two forms of beam in the walls of two adjacent sections,

FIGURE 8 is an elevation taken on the line VIII—VIII of FIGURE 7,

FIGURE 9 is an elevation taken on the line IX—IX in FIGURE 7,

FIGURE 10 is a horizontal section showing two further forms of beam in the walls of two adjacent sections, and

FIGURE 11 is a vertical section taken on the line XI—XI in FIGURE 10.

Description of preferred embodiments

Referring to FIGURES 1 and 2, the bungalow comprises five sections **1**, **2**, **3**, **4** and **5**, each of which encloses part of the overall space of the bungalow and includes of a wall portion, a floor portion and a ceiling portion, the latter forming part of the roof of the bungalow.

FIGURE 3 shows the parts of the section **1**, consisting of a floor **6**, walls **7**, **8**, **9**, **10** and **11** and a ceiling **12**. The floor **6**, the walls **7**, **8**, **9**, **10** and **11** and the ceiling **12** are first manufactured separately and subsequently joined to each other to form the section shown in FIGURE 4.

The floor **6** comprises four beams **13**, **14**, **15** and **16**, forming a rectangular frame along the periphery of the floor. The beams **13** and **15** are parallel to each other, as are the beams **14** and **16**. The section **1** is a parallelepiped, the floor **6** having two long beams **13** and **15** and two short beams **14** and **16**. The beams **13**, **14**, **15** and **16** are channel-section metal beams, the beams **14** and **16** being in contact with the beams **13** and **15** inside the limbs of the latter (see FIGURE 6). Between the beams **13**, **14**, **15** and **16** the floor comprises a concrete plate **17** (see FIGURE 6) which is cast between the beams **13**, **14**, **15** and **16**.

Each of the walls **7**, **8**, **9**, **10** and **11** has two vertical profiled metal beams such as, for example, beams **18** and **19** of wall **11**, between which a plate of concrete such as, for example, plate **20** (see FIGURE 6) is provided by casting. The concrete plate **20** is cast between the beams **18** and **19** in such a manner that after hardening of concrete said beams are affixed to plate **20**. It may be advantageous for this purpose to provide a channel-section profile of the beams, so that the edges of plate **20** are held between the limbs of the channel-section beams. The beams **18** and **19** may be formed with a channel-section shape or be provided with extensions so that the connection between the beams **18** and **19** and the plate **20** is stiffened, as will be described more fully hereinafter with reference to FIGURES 7 to 11. The walls **7**, **8**, **9** and **10** are constructed like the wall **11**, so that a further description thereof is unnecessary.

Referring to FIGURES 3 to 6, the ceiling **12** has two long beams **21** and **22** at the periphery and two short beams **23** and **24**, lying between the former. The further part of the ceiling is fixed to the beams **21** to **24** so that the upper side forms a substantially finished portion of the roof of the bungalow, whereas the lower interior side is constructed so that it can be finished according to the various spaces (not shown) of the section concerned. After the floor **6**, the walls **7**, **8**, **9**, **10** and **11** and the ceiling **12** have been manufactured, they are secured to each other. First the walls **7**, **8**, **9**, **10** and **11** and the floor **6** may be secured to each other. The beams **18** on the vertical sides of the walls are welded to the profiled metal beams along the edges of the floor **6**. While the walls are secured to the floor, a layer of material **25** (see FIGURE 6) is provided between the lower side of the wall and the upper side of the floor. The layer **25** is deformable so that cracks between the wall and the floor are filled up. The material of the layer **25** may be such

that it hardens after mounting. However, as an alternative, material which remains elastic may be employed. If desired, the layer **25** may be omitted and cracks, if any, between the lower sides of the walls and the upper side of the floor may be stuffed in a different manner. After the walls **7**, **8**, **9**, **10** and **11** and the floor **6** have been joined, the ceiling **12** can be arranged on the upper sides of the walls **7**, **8**, **9**, **10** and **11**. The beams **21**, **22**, **23** and **24** of the ceiling **12** are welded to the upper sides of the vertical beams **18** and **19** of the walls **7**, **8**, **9**, **10** and **11**. If desired, stops (not shown) may be arranged on the lower side of the ceiling **12** for engagement with the upper sides of the walls **7**, **8**, **9**, **10** and **11** so that these stops determine the correct positions of the walls **7**, **8**, **9**, **10** and **11** to the lower side of the ceiling.

Although, as described above, first the walls are secured to the floor and subsequently the roof is arranged on the upper sides of the walls, it is possible to arrange first the roof on the upper sides of the walls and afterwards to fasten the lower sides of the walls to the floor **6**.

The further sections are prefabricated like the section **1**. Thus, in the case of sections **2**, **3**, **4** and **5**, the walls, the floor and the ceiling are manufactured separately, these parts being subsequently secured to each other. The connection of the metal profiled beams of the walls, the floor and the ceiling provides a strong, rigid section which can be transported easily to the building site after the prefabrication, for example, in the workshop, on which site the building can be erected from one or more sections. With those sections in which the walls join each other, first the walls may be secured to each other, after which the interconnected walls are secured to the floor and the ceiling.

If a door has to be provided in a wall of a section, the door frame may be arranged therein when the wall is cast. FIGURE 5 shows a wall **26**, in which a door frame **27** is provided. This wall **26** may form part of the section **2**, which is shown in FIGURE 2. When the wall is formed in a jig, the beams **28** and **29** and the door frame **27** may be arranged therein. After these beams and the door frame have been arranged in place in the jig, concrete can be cast into the jig, so that a fixed connection between the beams, the door frame and the concrete is obtained. Although this is not shown in detail in FIGURE 5, the door frame **27** may have such a shape that it is satisfactorily anchored in the concrete. To this end if desired, iron anchors may be secured to the door frame.

In order to obtain light-weight walls of the sections, they may be made of light-weight concrete. In principle, the walls may be made of materials other than concrete.

FIGURE 7 shows two beams **30** and **31**, which form vertical beams of adjacent walls of neighboring sections. The vertical beam **30** consists of two substantially U-shaped strips **32** and **33**, the U-shaped strip **33** being arranged between limbs **34** and **35** of the U-shaped strip **32**. A web **36** of the U-shaped strip **32** has a V-shaped portion **37**, pointing towards the interior of the beam **30**. The V-shaped portion **37** extends throughout the length of the beam **30**. The U-shaped strip **33** has two limbs **38** and **39** and a web **40**. The ends of the limbs **38** and **39** are approximately even with the ends of the limbs **34** and **35**. In order to obtain a satisfactory anchorage of the beam **30** in concrete plate **41** of the wall concerned, the limbs **38** and **39** are provided throughout their lengths with spaced portions **42**, curved towards each other (FIGURE 9). Cavities **43** for accommodating the concrete of the wall **41** are thus formed between the limbs **34** and **35** of the U-shaped strip **32** and the limbs **38** and **39** of the U-shaped strip **33**. This provides a satisfactory connection between the beam **30** and the concrete **41**.

The beam **31** is shaped substantially in the same form as the beam **30** and corresponding parts are therefore designated by the same reference numerals. In the embodiment of the beam **31**, however, the limbs **38** and **39** have inwardly bent-over ends throughout the length (see FIGURE 8). Thus a V-shaped recess **44** for accommodating the concrete of the wall **45** is formed between the limbs **38** and **39** and the limbs **34** and **35** so that the beam **31** is satisfactorily anchored in the concrete plate **45** of the wall concerned. When the sections comprising the beams **30** and **31** are joined, a filling substance **46** is provided between the beams **31** and **30** in the V-shaped recess **37** of said beams.

FIGURES 10 and 11 show beams **47** and **48** of joined walls of adjacent sections. The beams **47** and **48** are again formed by U-shaped strips **49** and **50**. In this embodiment the webs **51** of the U-shaped strips **49** are flat so that the beams join each other by these flat sides. The web **52** of the U-shaped strip **50** is provided with tags **53**, which are bent over out of the web **52**. The tags **53** have a bent-over end **54**. The tags **53** provide a satisfactory anchorage of the beam **47** in the concrete plate **55** of the wall. Various tags **53** may be provided throughout the length of the beam **47** at given distances from each other. In order to avoid concrete from penetrating through the openings **56** into the interior of the beam **47**, these openings may be closed when the concrete is cast; for example, a beam may be fitted in the interior of the beam **47**. The beam **48** has differently shaped extensions, which are held in concrete plate **57** and provide a satisfactory anchorage of the beam **48** in the concrete plate **57**. The beam **48** is provided with hooks **58**, having bent-over ends **59**. In the embodiment shown in FIGURES 10 and 11, the hooks **58** lying one above the other, are alternately arranged so that the bent-over portions **59** are orientated to different sides, in the concrete plate **57**. The embodiments shown in FIGURES 7 to 11 may all be employed as U-shaped profiled beams in the walls of prefabricated sections.

The walls of the sections described above may be provided, after the floor and the roof have been arranged in place, with a coating, for example wall paper so that each prefabricated section is completely finished before it is joined to further sections to form the bungalow.

When the sections are intended for use in a multistory building, the ceiling side of the sections will be adapted to this purpose. The upper side of a section which will have a section of a higher story arranged thereon need then not have a roof portion of the building, while, the ceiling must be suitable for arranging the section of the higher story thereon. By forming separately the floor, the walls and the ceiling before joining them to each other, the manufacture can be carried out quickly. Although the metal beams of the walls, the floor and the ceiling are welded to each other, they may, in principle, be secured to each other in a different manner.

It will be understood that in another form of the invention, only one of the walls of the section is provided with the profiled metal beams.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A prefabricated section for a building, the section comprising a wall portion, a floor portion and a ceiling portion, at least one wall portion of the section comprising profiled metal beams between which concrete material is cast, further profiled metal beams in said floor portion and said ceiling portion forming a rectangular framework about the edge of their respective portions, the first mentioned profiled metal beams being secured to said further profiled metal beams, said first mentioned profiled beams being formed by two U-shaped metal strips, one strip being fitted between the limbs of the other U-shaped strip, with the limbs of the two strips extending in the same direction, extensions from the inner of said strips embedded in said concrete.

2. A prefabricated section for a building, said section having wall portions, a floor portion and a ceiling portion, at least one of said wall portions of said section com-

prising profiled metal beams at opposite vertical sides, said beams having a rectangularly shaped hollow part and inward extensions and at least two parallel limbs extending away from said hollow part, cast concrete material received in secured engagement between said limbs, said inward extensions from said hollow part embedded in said material, said profiled metal beams being flat on their edges opposite said cast material received in said limbs, further profiled metal beams in said floor portion and in said ceiling portion, the first mentioned of said profiled beams being secured to said further profiled beams.

3. A prefabricated section for a building, the section comprising a wall portion, a floor portion and a ceiling portion, at least one wall portion of the section comprising profiled metal beams between which material is cast, further profiled metal beams in said floor portion and said ceiling portion, the first mentioned profiled metal beams being secured to said further profiled metal beams, said floor portion situated between said profiled metal beams comprising cast concrete, said profiled metal beams being each formed by two U-shaped metal strips, one strip being fitted between the limbs of the other U-shaped strip, with the limbs of the two strips extending in the same direction.

4. A section as claimed in claim 3, wherein the web of the outer U-shaped strip is provided with a groove.

5. A prefabricated section for a building, the section comprising a wall portion, a floor portion and a ceiling portion, at least one wall portion of the section comprising profiled metal beams between which material is cast, further profiled metal beams in said floor portion and said ceiling portion, the first mentioned profiled metal beams being secured to said further profiled metal beams, said first mentioned profiled beams being formed by two U-shaped metal strips, one strip being fitted between the limbs of the other U-shaped strip, with the limbs of the two strips extending in the same direction, the limbs of the the inner U-shaped strip being corrugated in the direction of length of the beam whereby parts of the limbs of the inner U-shaped strip are alternately in contact with the limbs of the outer strip and are at a distance therefrom.

6. A prefabricated section for a building, the section comprising a wall portion, a floor portion and a ceiling portion, at least one wall portion of the section comprising profiled metal beams between which material is cast, further profiled metal beams in said floor portion and said ceiling portion, the first mentioned profiled metal beams being secured to said further profiled metal beams, said first mentioned profiled beams being formed by two U-shaped metal strips, one strip being fitted between the limbs of the other U-shaped strip, with the limbs of the two strips extending in the same direction, the ends of the limbs of the inner U-shaped strip being bent over inwardly throughout the length of the beam.

7. A prefabricated section for a building, the section comprising a wall portion, a floor portion and a ceiling portion, at least one wall portion of the section comprising profiled metal beams between which material is cast, further profiled metal beams in said floor portion and said ceiling portion, the first mentioned profiled metal beams being secured to said further profiled metal beams, said first mentioned profiled beams being formed by two U-shaped metal strips, one strip being fitted between the limbs of the other U-shaped strip, with the limbs of the two strips extending in the same direction, the web of the inner U-shaped strip provided with inwardly extending extensions.

8. A section as claimed in claim 7, wherein said extensions are formed by portions bent out of the web of the inner U-shaped strip.

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U.S. Cl. X.R.

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