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(54) **Prefabricated structures, method for their manufacture and their use in the building industry.**

(57) The prefabricated structure 9a, 9b comprises a three-dimensional metallic framework 9 of welded steel wires and one or more panels 15 of insulating material. The structures with a single panel are used as partitions or floors, and those with two panels are used as forms for casting concrete 18 which fills the void between the two panels and permits this structure to be used as a supporting element in a building. The individual prefabricated structure can be combined with each other by means of a small number of linking components which allow the simple construction of external and internal walls and other constituent parts of the building under construction.

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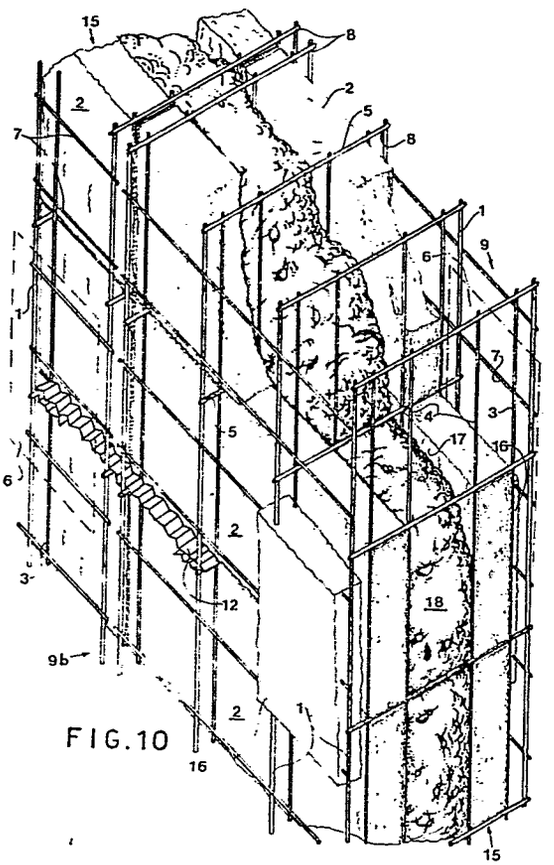

FIG.10

PREFABRICATED STRUCTURES, METHOD FOR THEIR MANIFACTURE AND THEIR USE IN THE BUILDING INDUSTRY

This invention concerns a prefabricated structure, particularly for use in the building industry, comprising a framework of welded steel wires, supporting a panel in lightweight material.

This type of prefabricated structure is well known in a form where the framework rests on a convenient structure and is covered with polyurethane foam. When the polyurethane hardens, it forms an insulating buffer inside the framework. The residue which issues from the framework is eliminated and it is advisable also to brush down the other parts of the framework to remove the excess polyurethane and to facilitate the setting of the plaster on the framework itself.

This structure results costly as a consequence of the necessity to use a foam-making machine and of the additional work of removing excess material. The larger surfaces of the structure result to be irregular and the wires forming the framework project to some extent from the polyurethan. This leads to the use of a notable thickness of plaster, with a consequent aggravation of the cost of both materials and labour. Moreover, structures of this type can only be of the "supported" type, i.e. they serve only to define the boundaries of the spaces.

The technical problem of the present invention is to produce a lightweigth prefabricated structure at relatively low cost, which can be implemented and put into operation easily, using unskilled personnel, and which can also be used in "supporting" components of the building.

This problem is solved through the prefabricated structure of the

invention which, in accordance with one of its outstanding features, comprises a second panel supported by the framework at a predetermined distance from the first panel, and wherein these panels are used as form for a concrete casting to fill the void and to act as an integral part of the building structure.

In accordance with another feature, the framework is formed by a series of trellises which define the boundaries of the larger surfaces of the prefabricated structure and which are kept at predetermined mutual distances through transverse wires welded on these trellises and each trellis is provided with at least two longitudinal wires, welded to the longitudinal wires, which define a series of sections in which are contained corresponding sections of the said panel in positions which are predetermined with regard to the larger surfaces of the prefabricated structure.

These, and other features of the invention will be apparent from the following description, which is given by way of non-limiting example, with reference to the accompanying drawings in which:

Fig. 1 represents a schematic perspective view of the structure of the invention.

Fig. 2 is a schematic, vertical section of the structure of figure 1 and variants on it.

Fig. 3 is a schematic vertical section of another version of the structure in accordance with the invention.

Fig. 4 is a frontal view of a combination of two prefabricated structures in accordance with the invention, joined to each other and to parts of the building.

Fig. 5 is a view of a component linking the prefabricated structure with parts of the building.

Fig. 6 is a view of other components linking the structure with parts of the building.

Fig. 7 is a vertical section of the structure of figure 3 anchored to the foundation of the building.

Fig. 8 is a vertical section of a structure of figure 1 used in a floor of the building.

Fig. 9 is a vertical section of two prefabricated structures as in figures 2 and 3, used as supporting horizontal and vertical components of the building.

Fig. 10 is a perspective view of two structures as in figure 3, joined together and used as vertical supporting components of the building.

Fig. 11 is a horizontal section of another variant of the invented structure.

Fig. 12 is a horizontal section of a further variant of the structure of the invention.

The prefabricated structure, generically denoted by 9a, 9b (figs. 1 and 10), comprises a three-dimensional framework 9 made of metallic welded wires, and at least one panel 15, in lightweight heat-insulating material, placed parallel to the largest furfaces 6 of the structure 9a, 9b.

The framework 9 comprises a series of trellises 8, identical to each other, essentially flat and in the form of a greatly elongated rectangle. The trellises 8 are placed one in front of the other, perpendicular to the two surfaces 6, and are kept firmly in their respective positions by means of a double series of transverse wires 7. When the structure 9a, 9b is in use, the trellises 8 will be vertical, while the transverse wires 7 are horizontal and adjacent to the largest surfaces 6 of the structure 9a, 9b. Two layers of plaster 16 cover the wires 7, forming the two largest surfaces 6 of the of the structure 9a, 9b.

The prefabricated structure with a single panel 15, denoted by 9a is used to form partition and floors and the prefabricated structure with two insulating panels 15, denoted by 9b (figs. 7 and 10), is used to form supporting walls of the building under construction.

Each trellis 8 is obtained by welding together a pair of longitudinal and parallel wires 1 (vertical when the structure is in use) with separating wires 5 in such a way as to form a small staircase with steps of a constant width and pitch. Between the longitudinal wires 1 and a short way away from them, equal to the thickness of the plaster, the trellises 8 include other longitudinal wires 3 parallel to the wires 1 and also welded to the separating wires 5. The welding is carried out electrically at certain points, resting the trellises 8 on a magnetized plate provided with gauges. The length of the wires 1, 5 and 7 is equal respectively to the heigth, the tickness and the width of the prefabricated structure 9a, 9b. The transverse wires 7 are welded to the longitudinal wires 1 and produce a ligth-weigth, stable framework in which the separating wires of a similar sequence of step prove to be in the same plane as, and perpendicular to, the planes of the wires 1 and 3.

Satisfactory structures have been built in which the diameter of the wires is 2,2 mm. In a typical case, the heigth of the stucture lies within the range 2,60-3,50 mm. and its width is 1,20 m.; the thickness is approximately 0,10 m. for structures 9a, 9b and approximately 0,15-0,30 m. for structures 9b; the trellesis 8 have an interval of approximately 0,10 m. and the pitch of the transverse wires 7 is approximately 0,07 m.; the pitch of the separating wires 5 is approximately 0,15 m. and the distance between the wires 1 and the wires 3 is approxmately 0,04 m. It is obvious that these values are purely illustrative and may vary according to the particular requirements of the construction.

The panels 15 can be made of various cellular material such as polyurethane foam, polystyrene and PVC of medium density, or of fibrous materials such as fiberglass, or of lamellate materials, or of a mixture of materials. In short, in specific case the material may even be non-insulating or non-metallic.

The panels 15 are subdivided into parallelepiped lumps 2 of a definite thickness and heigth, respectively 0,04 and 0,15 m. in the given example.

In structures 9a for partitions, the parallelepiped space in rectangular section defined by the two pairs of wires 5 and 3 of each sequence of trellises 8 is occupied by corresponding lumps of ligthweigth material 2 and its section is essentially equal to the available space, and its length equal to the width of the structure 9a. After the forming of the framework 9, the individual parallelepipeds 2 are inserted in the corresponding spaces between the wires 3 and 5. This is made possible by the compliance of the parallelepipeds 2 and of the wires 3 and 5. The structure is ready to put into operation, lacking only the plaster for re-covering the space between the wires 1 and 3. Wires 3 hold the lumps 2 in place between the surfaces 16 of the structure and correctly aligned with each other.

In the structure 9b (figs. 3 and 10), the trellises 8 comprise, besides wires 1 and 3, two further longitudinal wires 4, welded to the separating wires 5 and placed between wires 3 parallel with these same wires 1 and 3, which provide stops for the two panels 15. When the framework 9 is completely assembled, the separating wires 5 of an identical sequence of steps to trellises 8, together with the two pairs of wires 3 and 4, define two parallelepiped spaces in rectangular section for the whole width of the framework itself. These spaces are occupied by lumps 2 inserted as in the framework

of structure 9a. When all the spaces have been filled with the lumps 2, the structure 9b proves to be composed of a three-dimensional metallic framework with two panels in ligthweigth material separated by a void 17. This void may be filled directly by a casting of concrete 18 whose form is determined by the panels 15 implemented with the lumps 2 (fig. 9).

The concrete 18 makes it possible to use the structure 9a as a supporting structure for other parts of the building and renders simple the integration with other horizontal or vertical structures in the building. Moreover the resistance of structure 9b to the various stresses can be improved by inserting in the void 17 a framework of vertical 19 or horizontal 23 bars. The resistent concrete sections 18 and therefore the distance between the panels 15, the number and the section of the bars 19 and 23 are determined by the designer of the building with the usual rules for reinforced concrete and, as a precaution, the contribution of the framework 9 of the structure 9b is not taken into account.

The prefabricated structures 9a, 9b may be modified in the builder's yard using saw and shears to adapt it to particular requirements of the building. For example, one of the two panels 15 in structure 9b may be interrupted to allow space for a concrete pillar 32 (fig. 11), which will be of a piece with the concrete 18 which fills the void 17.

Other structures may be altered from production on. A structure 9c (fig. 2) consists simply of a framework of longitudinal wires 40, of short spacing wires 41 and of transverse wires 42. This structure is particularly adapted to strengthening work and as support for plaster during restoration work.

The structures with a single panel 15 may have a simplified form 9d with only three longitudinal wires for each trellis, when the plastering of one of the sides of the structure itself is of no importance. I.e., one

of the two wires 3 is eliminated. The structures with a single panel may also take the form denoted by 9e, in which the ligthweigth material consists of large parallelepipeds 43 which give the structure an increased thickness indispensable for its use as a floor.

As another example, some 9b structures (fig. 12) have one side modified to form the walls of a corner. In particular, a terminal trellis 44 has a single series of rectangular sections, the panels 15 have their edges bent at an angle of 45° and the edge of one panel juts beyond the other by an amount equal to the thickness of the panel 15. This variant permits the simple formation of a supporting corner wall, using two of these structures reversed. Two series of small steel rods 39 sunk in the block of concrete 18 ensure the necessary resistance at the corner structure, together with other linking components 45 of the adjoining wires 1. Some linking components of a particular type permit an outstanding utilisation of structures 9a and 9b, both in mutual links and in links with other structures in the building.

The horizontal junction between two structures 9a and 9b is achieved with steel straps 12 inserted between the wires 1 and 3 on both sides of the structure (fig. 4 and 10) and their extremities engage with the parts of the two wires 5 which protrude from the panels 15. The straps are then covered with plaster 16. Moreover, to improve the adhesion of the plaster, the straps 12 are corrugated and have sawn edges. These straps, placed at various heigth, ensure a secure linking and reduce the possibility of error in the joining together of the two structures.

The joining of the structures 9a, 9b and 9c and the horizontal structures of the building is reinforced by means of simple short shaft 46 of improved adhesion, of steel rods 28 (fig. 6) in a U-shape, of angle iron, and of reinforcing components 30 made of welded wires (fig. 5), these too being angled. The components 30 comprise three steel rods 21,

20 and 22 parallel to each other and placed in correspondence with the vertex and the extremities of the arms of the L-shaped section via the wires 25 bent into an L or via a pair of wires in a sinuous pattern welded respectively between the end rod 20 and the vertex rod 21, and between the rod 21 and the other rod 22.

To put the supporting walls into operation, a foundation 48 (fig. 7) of reinforced concrete is used and care must be taken to insert the short shafts 46 in the areas where the panels 9b will be inserted and allowing the shafts 46 to protrude from the surface of the foundation. The structure 9b are then rested on the foundation in such a way that the void runs across the shafts 46 and that the sides of the various structures match. The structures are joined together with the rods 12 and reinforcing components 30 are placed on top of them, if necessary inserted between the lump 2 and the wire 1 (fig. 9). Finally, the concrete casting is used in the void 17.

To construct a supporting floor, structures 9e are used, of half the normal width (0,60m. in the preceding example), and they are reinforced at the edges by means of an angle-iron 47 (fig. 8), used in pairs, to form an inverted T-shaped beam which meets the adjoining edges of the two structures 9e. At the edges of the structures 9e the wire 5 which protrudes below the last parallelepiped 43 is cut and the lowest edge of the same parallelepiped 43 is bevelled. Finally, one side of the angle-iron is inserted between the parallelepiped 43 and the wire 1. More components of the same kind are rested on the supporting structures of the building and converge to form the floor of the desired width. The whole may be inserted in the concrete 18 which is retained by the two wings of the inverted T in the areas of the links between the two half-structures 9e.

To join the walls of the various levels to each other and to the horizon-

tal floors, the procedure is as denoted by figure 9, inserting the rods 28 which are U-shaped across the transverse wires 5 and uniting the whole by means of a casting of concrete. Where necessary, rods 19 and 23 and the reinforcing component 30 were inserted and horizontal beams were implemented, using a lump 2 of specific thickness instead of a parallelepiped for the bearing part of the floor. The hollow part was used as a form for the beam of reinforced concrete 49 with the rods 23.

Once the structure is in use, the installation of plumbing and electrical wiring 50 (fig. 4) is facilitated by the "holds" represented by the wires 1, 3 and 7. The subsequent covering of the plaster 16, both for the walls and for the inner surface of the floors can be carried out by hand or with a plastering machine without the need for comparisons. The wires 1 and 7 are in fact almost in the same plane and the plaster will be perfecly flat when it barely covers the wires 7.

From this description it is clear that with a few simple components the prefabricated structure of the invention makes possible the implementation of buldings in a simple and inexpensive manner, using generic workers. The individual structures will prove ligth and easily transportable. In use, by contrast, the structure will prove very strong and will have excellent heat-insulation characteristics. It is also suitable for use in seismic zones.

It is obvious that skilled technicians may apply modifications and variations to this invention, to the manner in which it is implemented and to its use in the building industry, without departing from the context of the invention.

CLAIMS

1. Prefabricated structure, in particular for building purposes, comprising a framework of welded steel wires supporting a panel, characterised by a second panel supported by the framework at a predetermined distance from the first panel in such a way as to define an internal void, and in that said panels are used as the form for a concrete casting made to fill said void and to be integrated into the structure of the building.

2. Prefabricated structure in accordance with claim 1, characterised in that the framework is formed by a series of trellises perpendicular to the larger surfaces of the panels and furnished with principal longitudinal wires parallel to the said larger surfaces, with separating wires welded to the longitudinal wires and with catch components fixed to the separating wires and holding the said panels in positions which are predetermined with regard to said larger surfaces, and in that said trellises are held at predetermined mutual distances through transverse wires parallel to the said larger surfaces and welded to said trellises.

3. Prefabricated structure in accordance with claim 2, characterised in that said trellises are substantially identical to each other and the separating wires are welded in accordance with a predetermined sequence in such a way that the wires of said sequence of a trellis lie substantially in a single plane perpendicular to the plane of said larger surfaces, and in that said panels are subdivided into parallelepipeds which occupy the sections defined by the separating wires of said sequence and by said catch components.

4. Prefabricated structure in accordance with claim 3, characterised in that the catch components are represented by other longitudinal wires parallel to the principal longitudinal wires of the trellis.

5. Prefabricated structure in accordance with any one of the claims 2 to 4, characterised in that the principal longitudinal wires and the transverse wires are substantially in the same plane and define the larger surface of said structure.

6. Prefabricated structure in accordance with any one of the claims 1 to 5, characterised in that at least one of said panels includes heat-insulating material.

7. Prefabricated structure in accordance with any one of the preceding claims, characterised by a fixing component, including a steel bracket, which may be coupled to a separating wire next to one edge of said structure on the inside of said void to be included in the concrete of the building and in the concrete casting, to fill the void between the panels of the said structure.

8. Prefabricated structure in accordance with any one of the preceding claims, characterised by a strengthening component including a framework with L-shaped section formed of at least three wires welded to separating wires and in which one side is made to form a pair with one edge of the prefabricated structure in such a way that the separating wires may be included in the concrete casting and in which the other side of the framework is made to form a pair with the larger surface of the said structure.

9. Prefabricated structure, in particular in the building industry, comprising a three-dimensional framework of welded steel wires and a panel held in place by said framework and in which the framework is formed by a series of trellises which define the larger surfaces of the prefabricated structure and which are held at predetermined mutual distances by means of transverse wires welded to said trellises, characterised in that each trellis is furnished with at least one pair of

longitudinal wires and of separating wires welded to the longitudinal wires and which define a series of sections in which are contained corresponding sections of said panel in positions which are predetermined with regard to the larger surfaces of said prefabricated structure.

10. Prefabricated structure in accordance with claim 9, characterised by a linking component including a thin plate whose extremities are bent back and link with parts of the separating wires of two adjoining prefabricated structures included between the longitudinal wires and the larger surfaces of said structure.

11. Prefabricated structure in accordance with claim 9 or 10, characterised in that said structure may form a floor in conjunction with another prefabricated structure using a pair of strengthening frameworks, with an L-secion angle iron, joined in such a way that an inverted-T stucture is produced and in which said strengthening frameworks support the adjoining edges of the said structures and in which a casting of concrete includes said structures and said strengthening frameworks.

12. Prefabricated structure in accordance with any one of the claims 9 to 11, characterised in that each section of the framework is rectangular and is placed in a position symmetrical with an axis of said structure.

13. Method for the construction of supporting structures of buildings compring the steps of:

implementing structural components including a metallic framework and two panels held by the framework and defining a space between the two panels;

laying a foundation of reinforced concrete letting rods of steel project from the foundation;

resting a number of the said structural elements on the foundations in such a way that said space passes across the steel rods;

joining the structural elements together by means of metallic components

matched to the frameworks of the two adjacent structures;and

inserting a concrete casting in the space between the panels of said structural component to join the supporting structure to the foundation.

14. Method for obtaining a prefabricated structure including the steps of:

welding together a number of metallic wires in such a way as to form a trellis having rectangular sections of appropriate dimensions;

joining together said trellises welding to them a number of linking wires, in such a way as to align the said sections along a single axis; and

inserting into the said rectangular sections lumps of insulating material in such a way as to provide a single or double barrier against the passage of the heat.

15. Method for the construction of floors of buildings including the steps of:

implementing structural components with a metallic framework which includes a ligthweigth panel in such a way as to leave metallic parts on the outside of the said panel;

implementing a strengthening framework in the form of an inverted T;

resting the longitudinal edges of two of said stuctural components on said straigthening framework;

resting the strengthening framework and the structural components on supporting walls opposite each other, in sequence until the desired floor has been constructed;

inserting a concrete casting which includes the T-shaped framework and the structural component; and

deposing plaster on the interior surface of the floor until the framework of ligthweigth panels is completely covered.

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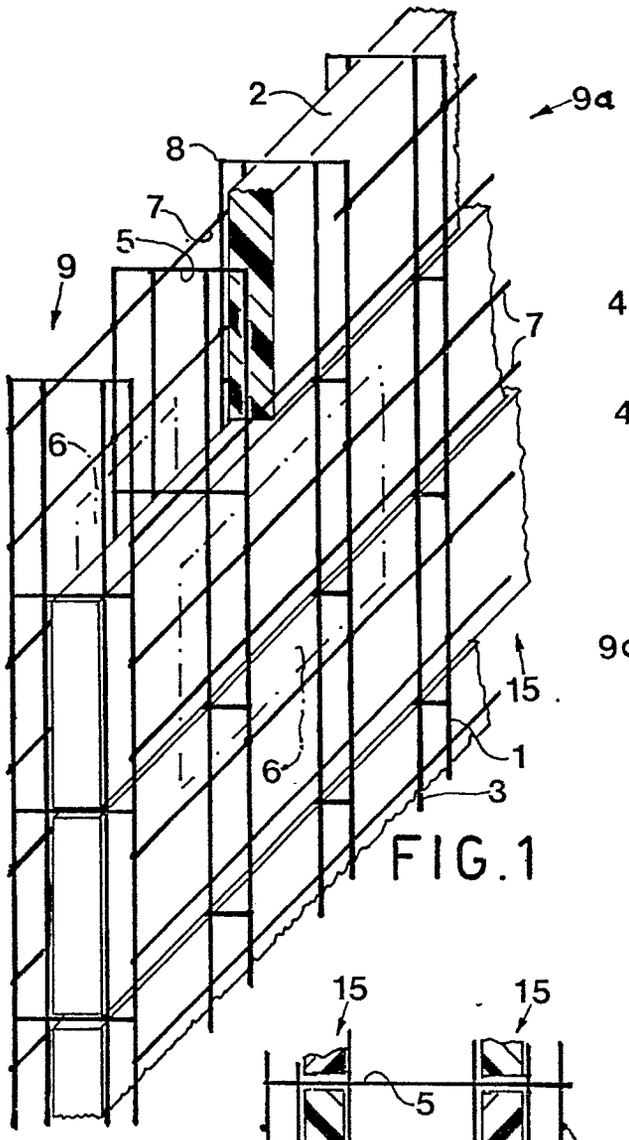


FIG.1

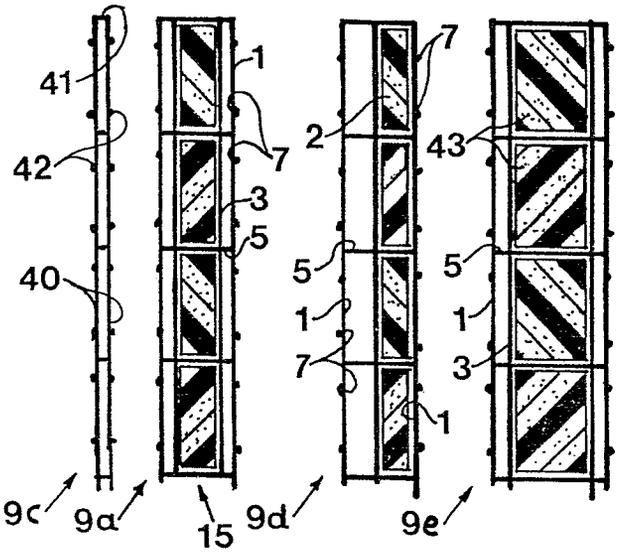


FIG.2

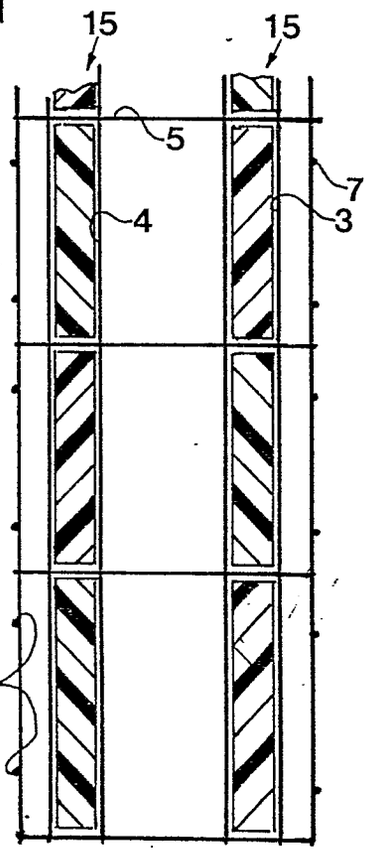


FIG.3

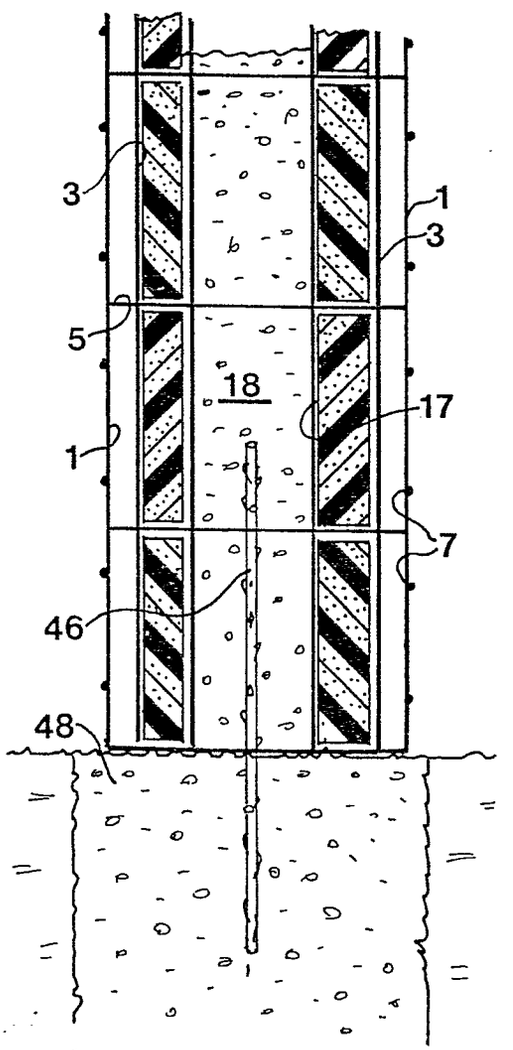


FIG.7

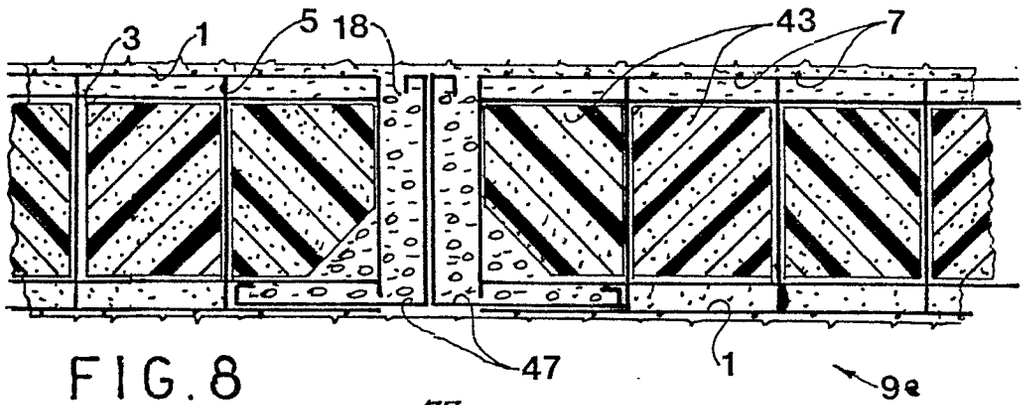


FIG. 8

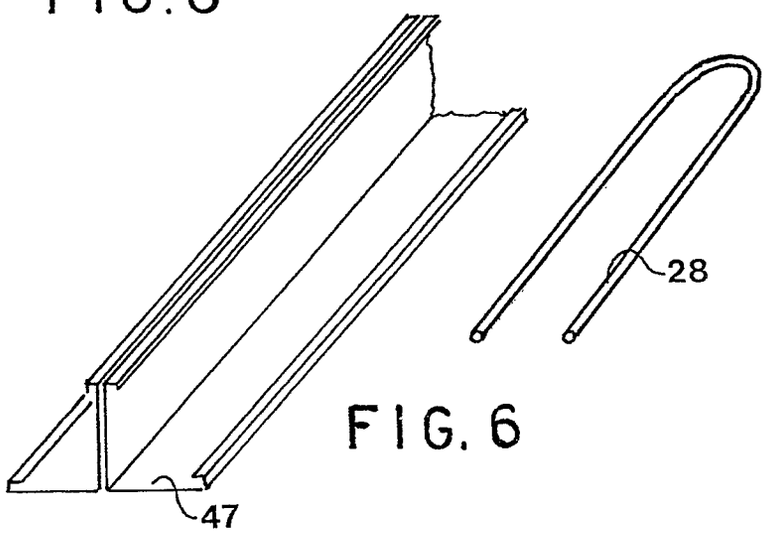


FIG. 6

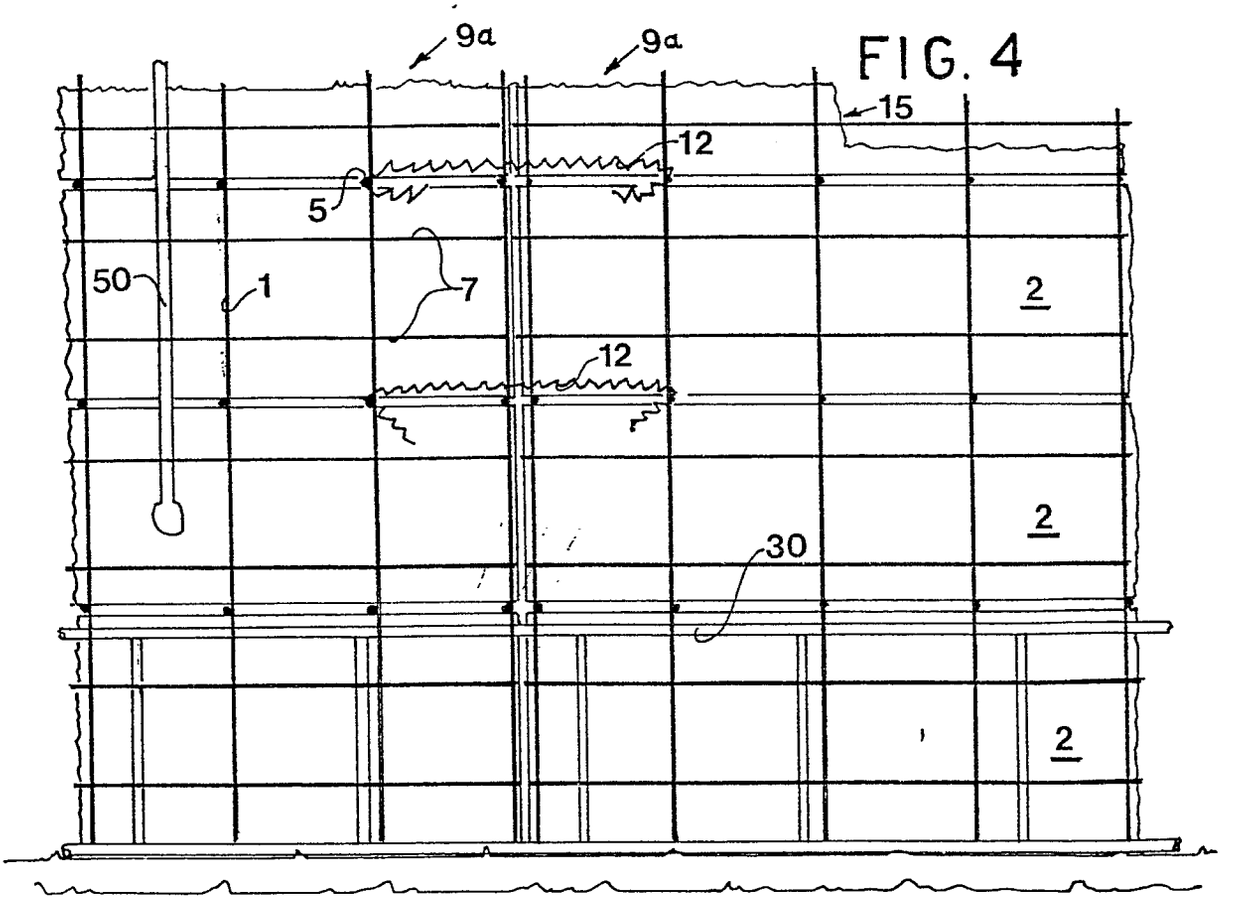


FIG. 4

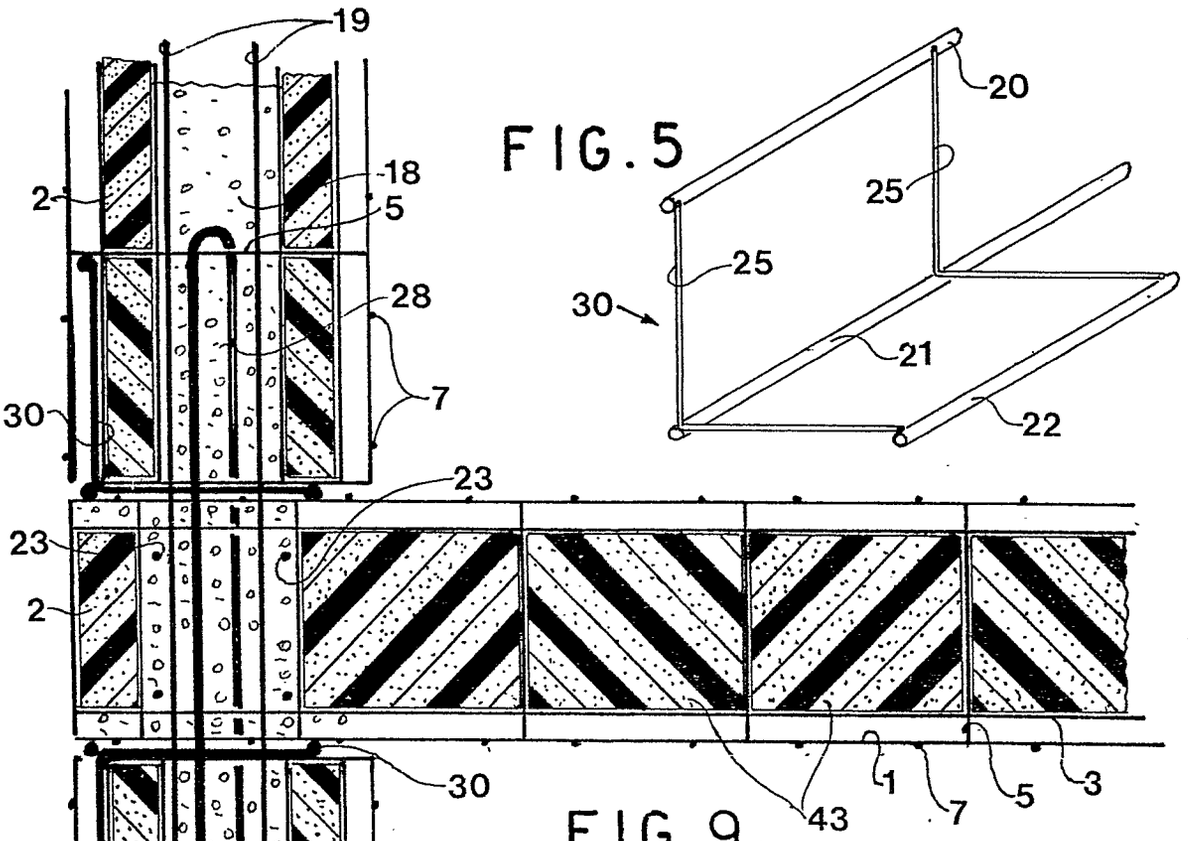


FIG. 5

FIG. 9

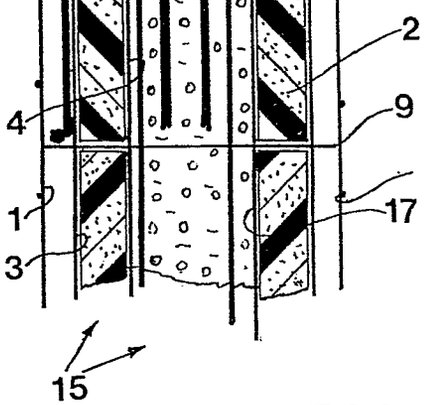


FIG. 11

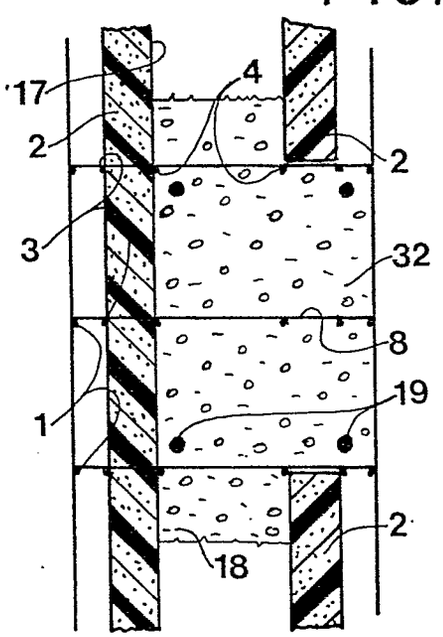
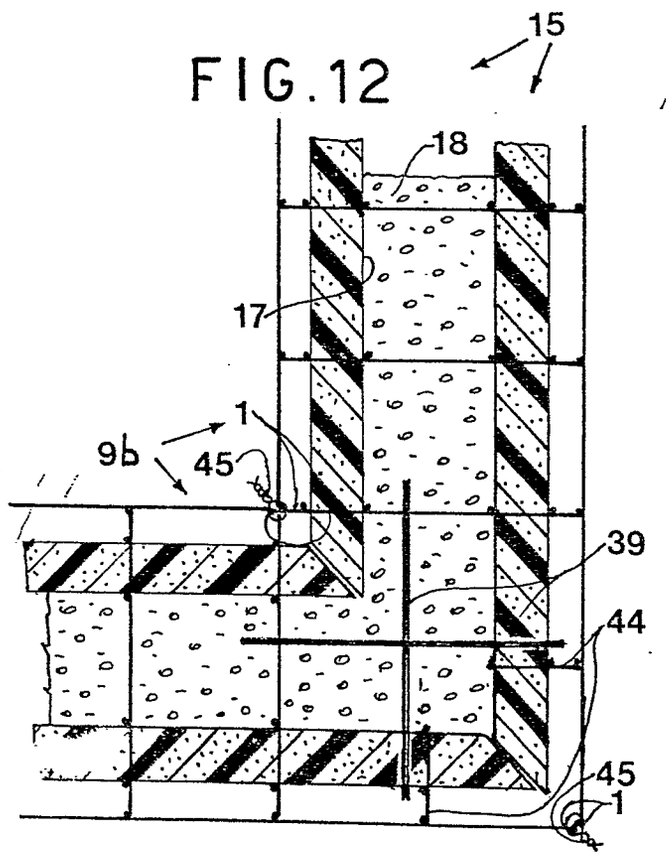


FIG. 12



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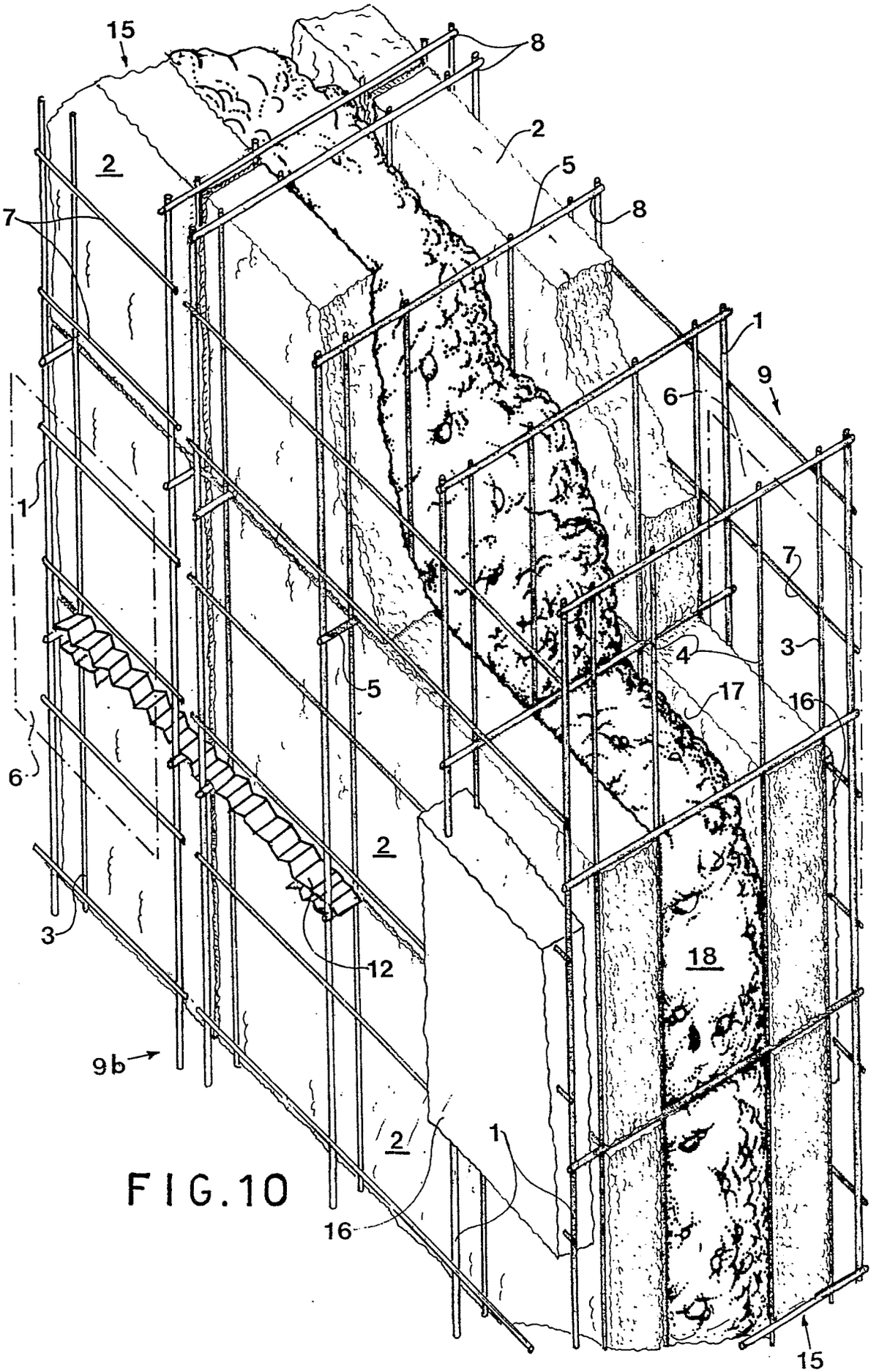

FIG.10