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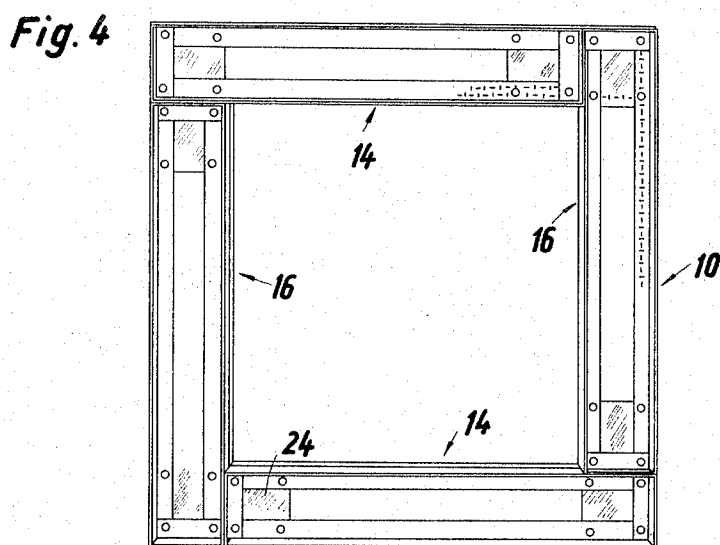
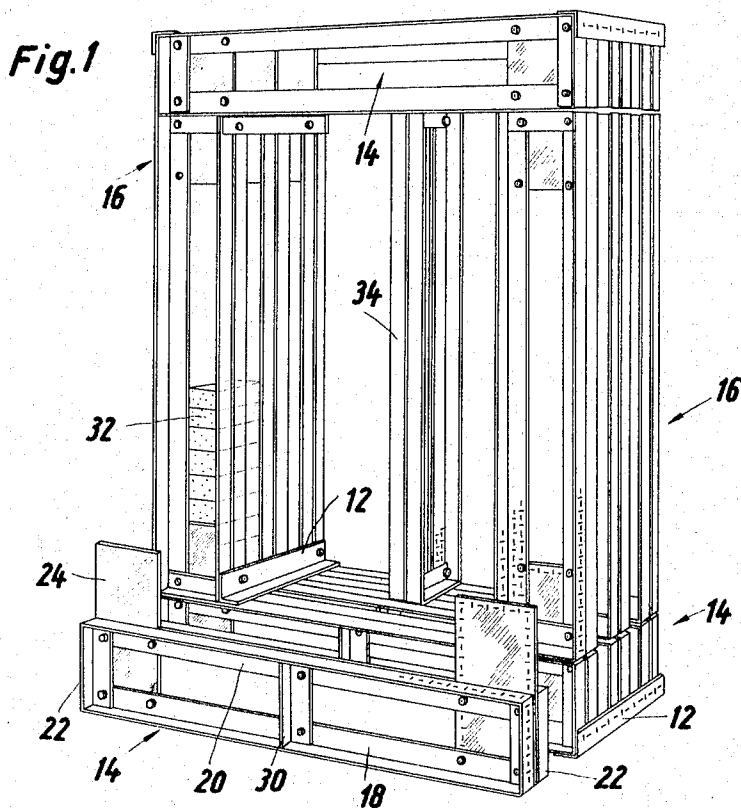
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3,302,349

SHELTER REINFORCEMENT

Filed March 19, 1964

2 Sheets-Sheet 1



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Fig. 2

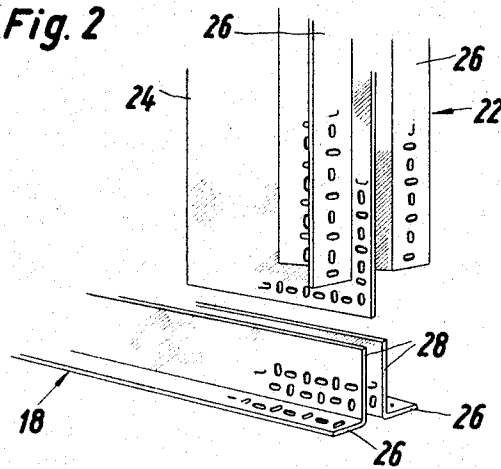
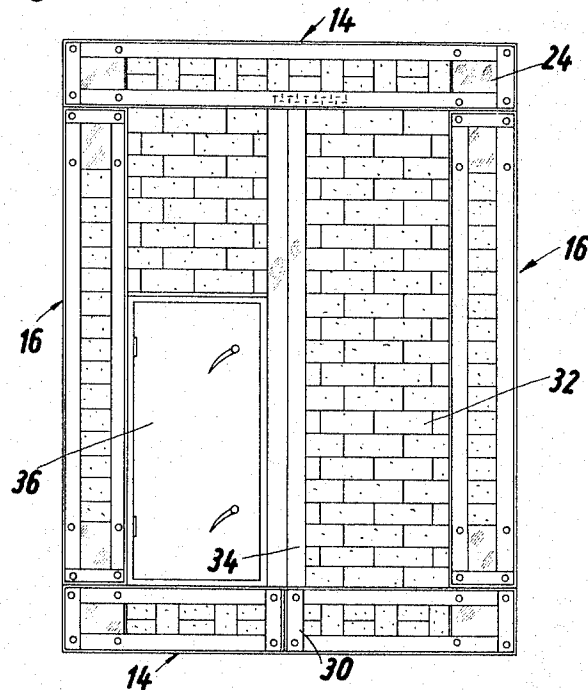


Fig. 3



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SHELTER REINFORCEMENT

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Z 10,004

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The invention relates to a shelter reinforcement. Shelters are used primarily for air-raid protection but they are also important in areas where there is a risk of earthquakes or storms, and in the chemical or explosives industries. It is the object of the invention to provide for a subsequent reinforcement by simple means of existing rooms, for example cellars or rooms above ground, to the extent of the security required. The shelter should provide people seeking protection with a living room which is secure against burial and collapse. In addition, security is necessary from shock waves and radiation, such as are threatened as a result of weapons known today. Shock waves strike with considerable force not only from above but also from the side, and to some extent even cause stresses in alternating directions. The reinforcement must withstand such stress. Furthermore protection is required against radioactive and thermal radiation. Finally, the action of gas must also be kept away from the interior of the shelter.

Numerous difficulties arise in meeting all the requirements. In adapting existing rooms, the given conditions, such as partitions and the like, must be taken into consideration. It should be possible for the reinforcement to be effected without any special costs and if possible by the civilian home defence. Accordingly, the solution must not be complicated and must not require any particular manual skill. It should be possible to achieve the building of the shelters quickly. The saving in building time is a requirement which applies not only to the adaptation of existing rooms but also to the new building of shelters. For example, it should be possible for members of the armed forces to provide themselves with safe accommodation in a short time by erecting shelters.

It has already been proposed to use frame panels for the building of which shelters panels consist of simple angle sections which can be assembled by oneself and which surrounded the shelter like a framework. The static security of such simple designs is limited, however. When existing rooms are reinforced, the disadvantage arises that either the frame panels are supporting the existing walls and ceilings directly in which case the thickness of the additional protective wall is too thin being necessarily determined by the dimensions of the angle sections, or the cross-sections of the frame panels are kept smaller than the internal space available. In the second case it is not possible to support the existing walls and ceilings. Instead, the gap remaining between the frame panel and the internal dimensions of the room must be filled up by inserting filling materials, such as concrete, or packing blocks such as stones. In this case it is inevitable that cavities remain which may lead to points of breakdown in an emergency.

All disadvantages and difficulties are overcome and all the requirements are met by the invention in a simple

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manner. Simple angle sections which have previously been drilled are used as shelter reinforcement, but with the new characteristic feature that the individual members of the reinforcement are elongated self-contained component frames which are built up from the angle sections. The members of the shelter reinforcement are essentially the upper and lower horizontal beams and the lateral uprights. Each four of these members form a frame panel which completely fills the internal cross-section of a room to be reinforced. Thus the existing outside walls or those to be erected are advantageously directly supported by the reinforcement. A plurality of frame panels are mounted one behind the other to form a longitudinal assembly and are joined together internally and/or externally at the edges by means of the same angle sections of which the frames consist.

As a result of the fact that the members are built up in the form of a frame, these members have a considerably greater bending, buckling and breaking strength and in addition they provide, on the inside, a space which can easily be filled with filling and packing materials. The filler or packing materials act as pressure members and as a result increase the strength and they afford protection against radiation and gas. Since the filling is effected inside a given frame, it is possible to adhere to a standardized size of store blocks or the like and laymen can carry out the adaption without professional experience. The spacing of the adjacent frame panels is determined by the standardized dimensions of the packing stone blocks which are to be introduced into the assembly.

The individual component frames or frame-shaped members can likewise be easily built up on site from a single size of angle section. No tools and no manual experience are needed. The weights involved can be easily managed.

Each upright and cross beam consists of a component frame with at least two longitudinal girders and at least two transverse girders. The longitudinal and transverse girders are assembled from two angle sections in such a manner that they produce a T-section. The superimposed legs of the angle sections face inwards into the frame of the upright or horizontal beam.

Each frame panel is composed of two upright and two horizontal beam frames, which are connected to one another by means of connection plates. The connection plates may be inserted advantageously between the angle sections.

A frame panel is either built up in such a manner that the uprights are placed between the horizontal beams, or in such a manner that each time one end of an upright is placed on one end of a horizontal beam, while the other end of the upright bears against the end of the other horizontal beam. With this arrangement, the two horizontal beams and the two uprights of a frame are arranged offset in relation to one another.

Which type of arrangement is selected depends on the local installation conditions. These also determine the length of the individual angle sections which provide the upright or horizontal beam frames. The cutting of the angle sections to size is effected by means of suitable metal shears. No other tools are needed. The angle sections are preferably pre-drilled, as a result of which a simple screw assembly is rendered possible.

At the end walls of the shelter, two adjacent frame panels are stiffened by additional transverse beams. These additional beams may be used as abutments for shelter doors and for the building of an air lock.

Further advantages and features will be apparent from the following description of the accompanying drawings, wherein

FIGURE 1 shows in perspective representation the construction of a shelter reinforcement,

FIGURE 2 shows in detail, the assembly of a corner of component frame,

FIGURE 3 shows a view of one end wall, and

FIGURE 4 shows a view of a modified form of construction of a frame panel.

The shelter reinforcement consists of frame panels 10, which are composed of horizontally arranged beams 14 and uprights 16 standing vertically. Each horizontal beam 14 and upright 16 consists of an elongated self-contained component frame. The construction of a component frame can best be seen from FIGURE 2. A single horizontal beam 14 lying at the bottom is shown in the assembled state in the foreground of FIGURE 1.

The component frames, for example of the horizontal beam 14, consist of a lower girder 18 and an upper girder 20. Transverse girders 22 ensure the connection between the upper and lower girders which form the longitudinal girders of the component frame.

The longitudinal and transverse girders are composed of angle sections 26 which are alike throughout and have been provided with holes or slots. The girders are delivered on site in any desired length and cut according to the given circumstances. The assembly is effected, for example by means of screws in such a manner that adjacent legs 28 of the angle sections 26 face inwards into the component frames. The component frame then consists of an advantageous T-section. A connection plate 24 is introduced between the angle sections at the same time during the assembly of the component frame.

In the example shown in FIGURE 1, the component frame of the front horizontal beam 14 comprises a central reinforcement 30 which may also be inserted at any other desired point or points. It may consist of a simple angle section or of a T-section or of an H-section.

A plurality of frame panels are connected together one behind the other and spaced apart by angle sections 12 which may be secured to the edges internally and/or externally.

The space formed within the component frames is filled with stone blocks 32. Instead of the stone blocks 32, another filler, for example concrete, may be selected. As a result of the bores in the sections, an advantageous improved bonding action is obtained between the concrete and the steel sections. Moreover, the air can escape through the holes during the filling with concrete.

The spacing between the frame panels arranged one behind the other is preferably selected in such a manner that the distance apart corresponds to the dimensions of the filling stone blocks. If bricks are used, the distance apart must amount to 30 cm. for example. The bricks then stand on the lateral legs of the angle sections or come to lie there so that the construction by experts of separate scaffolding or shuttering for the ceiling construction in shelters, which is otherwise difficult to perform, can be dispensed with. The ceiling stone blocks are simply placed from below or above or from the side on the legs of the angle sections which face towards the interior of the shelter where the joints are filled, that is to say cast, which can likewise be effected by laymen or quickly trained people.

The small component frames can be screwed together individually in rooms adjoining the cellar later to serve as a shelter and be finally assembled in the actual shelter progressing from the bottom upwards. Assembly is

facilitated as a result of the fact that the weights of the individual component frames can be mastered by anyone and therefore should not amount to more than 30 to 40 kg. The total weight of a frame without any filling material for a room with an internal width of about 2.60 m. and a height of 2.00 m. should scarcely exceed 150 kg. per frame panel. The weights and quantities required to be installed by laymen therefore vary within limits which enables both young and old to carry out the work themselves after short training by an expert.

Whereas in the example shown in FIGURE 1, the uprights 16 rest on the lower horizontal beams 14 and carry the upper horizontal beams 14, a modified form of construction is illustrated in FIGURE 4.

The frame panel 10 consists of uprights 16 and horizontal beams 14 which are alternately supporting and united laterally by means of the connection plate 24. Which of the two embodiments is more advantageous depends on the particular circumstances.

FIGURE 3 illustrates an end wall. In accordance with the rear part of FIGURE 1, there is provided a transverse component frame 34 which bears against two adjacent horizontal beams 14 at the top and bottom.

Instead of one transverse component frame 34, a plurality of such frames may be provided. In any case, however, the component frames 34 will be used for a gas-tight door 36 to strike against. An air lock can be provided with simple means inside the shelter behind the door 36.

The piping to be laid in a room receiving the reinforcement or already present therein, can be taken into consideration without difficulty during the construction of the reinforcement. There is the possibility of taking the pipes to be laid through the frames or component frames or of constructing the frames or component frames in such a manner that existing pipes are enclosed or bypassed. In both cases, there is the possibility of walling in the pipes. In the same manner, pipes for ventilation of any type may be provided and walled in. It is possible to prefabricate frame parts with pipe ducts inserted in the workshop once the dimensions of the room to be considered have been established.

What I claim is:

1. A shelter reinforcement particularly for air-raid protection purposes comprising a row of rectangular frames arranged in parallel vertical planes and connected together to form a box-like structure, each frame comprising four beams, each beam being made of angle sections having a row of openings therein enabling assembly by means of bolts, each beam being in the form of a sub-frame built up from two or more lengths of angle section, bolts extending through some of said openings and connecting said angle sections and said beams, each sub-frame being of rectangular shape with each side of the rectangle consisting of two lengths of angle section bolted together to form a T-shape, and the leg of each T lying within the rectangle.

2. A shelter according to claim 1 wherein connecting plates between adjacent beams of a frame are bolted between the two lengths of angle section of each beam which form the T-shape at the connection point.

3. A shelter according to claim 2 wherein an additional length of angle section traverses the rectangle mid-way between its ends.

4. A shelter according to claim 2 including a reinforcement in the form of blocks inserted between the frames of the shelter within the spaces defined by the angle sections of adjacent sub-frames.

5. A shelter according to claim 1 wherein a sub-frame is connected as reinforcement between the top and bottom beams of the end frame of the shelter.

6. A shelter reinforcement particularly for air-raid protection purposes comprising a row of rectangular

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frames arranged in parallel vertical planes and connected together to form a box-like structure, each frame comprising four beams, each beam being made of angle sections having a row of openings therein enabling assembly by means of bolts, each beam being in the form of a sub-frame built up from two or more lengths of angle section, bolts extending through some of said openings and connecting said angle sections and said beams, and a reinforcement in the form of blocks inserted between the frames of the shelter within the spaces defined by the angle sections of adjacent sub-frames.

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