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PATENT SPECIFICATION

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DRAWINGS ATTACHED



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(54) IMPROVEMENTS IN OR RELATING TO WALL FRAME STRUCTURES FOR BUILDINGS

(71) I, ERIC WILLIAM SATCHELL, an Australian citizen, of 688 Pacific Highway, Chatswood, New South Wales, Commonwealth of Australia, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to wall frame structures for domestic and commercial buildings and more particularly to steel wall frame structures.

The wall frame of a conventional timber formed building consists of upper and lower horizontal plates between which a plurality of studs extend. The frame also includes noggings and heads for windows and doors. The object of the present invention is to provide a similar type of wall frame construction from steel and particularly to provide a construction in which the studs and plates are joined by means which avoids wholly or partially the necessity for welding or the provision of nuts and bolts or rivetting.

The invention consists in a steel wall frame structure for buildings consisting of upper and lower plates between which extend a plurality of studs, each plate and each stud being formed from sheet steel folded to a channel section or other suitable section, the width of the studs and plates being such that each external surface of the wall frame structure lies in a single plane, at least one plate being formed at intervals along its length with inwardly projecting lugs or the like and each stud being formed at at least one end with slots or the like, the said end or ends of each stud being, by deformation of either stud or plate, inserted into a plate at an appropriate point and the slots on the stud engaged with the lugs in the plate so that the end of the stud is secured to the plate, thereby forming a wall frame structure.

able for the purposes of the invention include box sections and sigma sections.

In order that the invention may be better understood and put into practice a preferred form thereof is hereinafter described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of a steel wall frame according to the invention;

Figure 2 is a perspective view, to an enlarged scale of one end of a stud and portion of a plate illustrating the manner in which they are interconnected, and

Figure 3 is a perspective view showing portions of a stud and two noggings illustrating the manner in which they are interconnected.

In the preferred form of the invention both plates 10 and wall studs 11 of Figure 1 are made from galvanised steel sheet, of for example, 18 gauge. Each plate 10 is formed by folding up sheet steel to form a channel section having an external width of $3\frac{1}{2}$ " and a wall height of 1", each wall having at its upper edge an inwardly directed flange 13 of a width of $\frac{1}{4}$ ". It should be emphasised that these dimensions and other dimensions given in this specification are by way of example only to assist in an understanding of the invention.

At regular intervals along the plate, for example 12" intervals, the internally extending flanges 12 are cut away to a width equal to the thickness of a stud 11, a portion 13 of the material of the flange is, however, left in the middle of the space formed to constitute a lug for engagement with a corresponding slot 14 in a stud, details of which are described below. The formation of the cut away portions and lugs 13 is preferably carried out by punching out the sheet material before folding. The thickness of the studs 11 and thus the width of the cut away portions is preferably $\frac{1}{4}$ " and the width of the lug $13\frac{1}{2}$ ". The cut away portion on one flange 12 is formed immediately opposite a cut away portion on the other flange so

that the end of the stud can be accommodated between them. Plates are manufactured to any desired lengths and the spacing of the cut away portions may be at any desired intervals.

Each stud 11 is formed from galvanised sheet steel in a manner similar to the plates and consists of a channel section of an internal width $3\frac{1}{2}$ " and a depth of $1\frac{1}{2}$ ". The walls of the section are plain without any inwardly directed flange. Studs are made to a standardised length to provide the normal ceiling height and are shaped at each end in the manner described below for engagement with a plate.

At each end the width of the stud is reduced to $3\frac{3}{8}$ " for a depth of $1\frac{5}{8}$ " so that the end of the stud will fit within the channel section of a plate, the walls 15 of the stud lying closely against the sides of the plate. At the inner end of the reduced portion at each side, is formed a slot 14 which is preferably $1\frac{1}{8}$ " long and $\frac{1}{8}$ " wide which is preferably punched out before the metal is folded. The arrangement is such that the end of a stud may be inserted into a pair of cut away portions on a plate and, by deformation of the plate to spread the sides apart, the stud may be introduced into the space between the inwardly projecting lugs 13 so that on allowing the plate to return to its normal configuration the lugs will engage the slots 14 to hold the stud firmly to the plate with the end of the stud resting on the base of the plate. In this manner a complete wall frame can be built up from two plates and an appropriate number of studs, quickly and without the use of tools.

Preferably the base of each stud between the walls is cut away at 16 to allow service pipes and wiring to be laid along the plates.

Inwardly inclined portions 20 are formed at the ends of the studs to facilitate their introduction between the sides of the plate.

Adjacent studs 11 are interconnected by means of noggings 17 which fulfil the same function as their counterparts in a timber frame. In this case, however, the noggings 17 are formed from galvanised sheet steel folded to a channel section in the same manner as the studs and plates and at each end the base of the nogging is provided with a pair of projecting T-shaped lugs 18, the height of the stem of the T being approximately equal to the thickness of the material of the stud. Each stud is provided at intervals with pairs of T-shaped slots 21 the width of the head of the slot being equal to the width of the head of the lug 18 on the nogging 17 and the width of the stem of the slot being equal to the width of the stem of the lug. The arrangement is such that the lugs 18 on a nogging 17 may be offered up to the slots 21 on a stud 11 and passed through the heads of the slots. The

nogging may then be allowed to drop so that the stem of the lug enters the stem of the slot and the nogging is thus held in contact with the stud and cannot be pulled away from it. The slots are preferably constructed so as to accommodate two noggings one entering from each side of the stud. The end 22 of the nogging which is required to enter between the walls of a stud is made of a reduced width in a manner similar to the ends of the studs.

The slots 21 in each stud 11 described above are provided at suitable intervals throughout its length to accommodate not only noggings but also heads, window frames and sills for doors and windows all of which may be constructed in a manner similar to the noggings. The studs may be provided with $\frac{1}{4}$ " holes 23 at intervals for wall ties.

Suitable diagonal bracing for the wall frame may be provided in any convenient manner, the bracing being attached either by welding, by screws or by interengagement with slots in the studs.

Holes or knock-out sections may be provided in the plates and or studs to enable service wires or pipes to pass through the structure or for the placing of ties for bricks or other wall materials.

A particular point to note in connection with the construction described is that the channel sections forming the studs, plates and noggings are all of the same width so that each external side surface of the wall frame lies in a single plane thus facilitating the attachment of a wall cladding.

The embodiment of the invention described above is given by way of example only and may be varied within the scope of the invention claimed. It will be noted that the studs and plates are interengaged and secured together without welding, nuts and bolts or rivetting and while the means for interconnection illustrated in connection with the preferred embodiment it will readily be appreciated that other means may be adapted within the scope of the invention.

While it is preferred that both ends of each stud should be secured to a plate by means engaging with co-operating means on the plate and without the use of welding, nuts and bolts and rivetting, the advantages of the invention may be obtained in part if one end only of each stud is engaged with a plate, for example, the lower plate, and the other end is secured to the other plate by means, for example, of nuts and bolts.

WHAT I CLAIM IS:—

1. A steel wall frame structure for buildings consisting of upper and lower plates between which extend a plurality of studs, each plate and each stud being formed from sheet steel folded to a channel sec-

that the end of the stud can be accommodated between them. Plates are manufactured to any desired lengths and the spacing of the cut away portions may be at any desired intervals.

Each stud 11 is formed from galvanised sheet steel in a manner similar to the plates and consists of a channel section of an internal width $3\frac{1}{2}$ " and a depth of $1\frac{1}{4}$ ". The walls of the section are plain without any inwardly directed flange. Studs are made to a standardised length to provide the normal ceiling height and are shaped at each end in the manner described below for engagement with a plate.

At each end the width of the stud is reduced to $3\frac{3}{8}$ " for a depth of $1\frac{5}{8}$ " so that the end of the stud will fit within the channel section of a plate, the walls 15 of the stud lying closely against the sides of the plate. At the inner end of the reduced portion at each side, is formed a slot 14 which is preferably $\frac{1}{8}$ " long and $\frac{1}{8}$ " wide which is preferably punched out before the metal is folded. The arrangement is such that the end of a stud may be inserted into a pair of cut away portions on a plate and, by deformation of the plate to spread the sides apart, the stud may be introduced into the space between the inwardly projecting lugs 13 so that on allowing the plate to return to its normal configuration the lugs will engage the slots 14 to hold the stud firmly to the plate with the end of the stud resting on the base of the plate. In this manner a complete wall frame can be built up from two plates and an appropriate number of studs, quickly and without the use of tools.

Preferably the base of each stud between the walls is cut away at 16 to allow service pipes and wiring to be laid along the plates.

Inwardly inclined portions 20 are formed at the ends of the studs to facilitate their introduction between the sides of the plate.

Adjacent studs 11 are interconnected by means of noggings 17 which fulfil the same function as their counterparts in a timber frame. In this case, however, the noggings 17 are formed from galvanised sheet steel folded to a channel section in the same manner as the studs and plates and at each end the base of the nogging is provided with a pair of projecting T-shaped lugs 18, the height of the stem of the T being approximately equal to the thickness of the material of the stud. Each stud is provided at intervals with pairs of T-shaped slots 21 the width of the head of the slot being equal to the width of the head of the lug 18 on the nogging 17 and the width of the stem of the slot being equal to the width of the stem of the lug. The arrangement is such that the lugs 18 on a nogging 17 may be offered up to the slots 21 on a stud 11 and passed through the heads of the slots. The

nogging may then be allowed to drop so that the stem of the lug enters the stem of the slot and the nogging is thus held in contact with the stud and cannot be pulled away from it. The slots are preferably constructed so as to accommodate two noggings one entering from each side of the stud. The end 22 of the nogging which is required to enter between the walls of a stud is made of a reduced width in a manner similar to the ends of the studs.

The slots 21 in each stud 11 described above are provided at suitable intervals throughout its length to accommodate not only noggings but also heads, window frames and sills for doors and windows all of which may be constructed in a manner similar to the noggings. The studs may be provided with $\frac{1}{4}$ " holes 23 at intervals for wall ties.

Suitable diagonal bracing for the wall frame may be provided in any convenient manner, the bracing being attached either by welding, by screws or by interengagement with slots in the studs.

Holes or knock-out sections may be provided in the plates and or studs to enable service wires or pipes to pass through the structure or for the placing of ties for bricks or other wall materials.

A particular point to note in connection with the construction described is that the channel sections forming the studs, plates and noggings are all of the same width so that each external side surface of the wall frame lies in a single plane thus facilitating the attachment of a wall cladding.

The embodiment of the invention described above is given by way of example only and may be varied within the scope of the invention claimed. It will be noted that the studs and plates are interengaged and secured together without welding, nuts and bolts or rivetting and while the means for interconnection illustrated in connection with the preferred embodiment it will readily be appreciated that other means may be adapted within the scope of the invention.

While it is preferred that both ends of each stud should be secured to a plate by means engaging with co-operating means on the plate and without the use of welding, nuts and bolts and rivetting, the advantages of the invention may be obtained in part if one end only of each stud is engaged with a plate, for example, the lower plate, and the other end is secured to the other plate by means, for example, of nuts and bolts.

WHAT I CLAIM IS:—

1. A steel wall frame structure for buildings consisting of upper and lower plates between which extend a plurality of studs, each plate and each stud being formed from sheet steel folded to a channel sec-



- tion or other suitable section the width of the studs and plates being such that each external surface of the wall frame structure lies in a single plane, at least one plate being formed at intervals along its length with inwardly projecting lugs or the like and each stud being formed at at least one end with slots or the like, the said end or ends of each stud being, by deformation of either stud or plate, inserted into a plate at an appropriate point and the slots on the stud engaged with the lugs in the plate so that the end of the stud is secured to the plate, thereby forming a wall frame structure.
2. A steel wall frame structure for buildings consisting of upper and lower plates between which extend a plurality of studs, each plate and each stud being formed from sheet steel folded to a channel section, the width of the studs and plates being such that each external surface of the wall frame structure lies in a single plane, each plate being formed at intervals along its length with inwardly projecting lugs or the like and each stud being formed at each end with slots or the like, each end of each stud being, by deformation of either stud or plate, inserted into a plate at an appropriate point and the slots on the stud engaged with the lugs in the plate so that the end of the studs is secured to the plate, thereby forming a wall frame structure.
3. A steel wall frame structure as claimed in either of the preceding claims, including

noggings arranged at intervals between the studs each nogging being formed from sheet steel folded to a channel section and being connected at each end to a stud by means not involving the use of welding nuts and bolts or rivetting.

4. A steel wall frame structure as claimed in claim 3, wherein each nogging is provided at each end with a T-shaped lug and each stud is provided at intervals with T-shaped slots, the arrangement being such that the lugs of the noggings are engaged with the slots of the studs in such a manner that relative movement between the noggings and the studs lengthwise of the noggings is prevented.

5. A steel wall frame structure as claimed in any one of the preceding claims, wherein holes or knock-out sections are provided in the plates and/or the studs to allow pipes or wires to pass through the structure or to allow for the placing of ties for bricks or other wall materials.

6. A steel wall frame structure for building substantially as shown in and as described with reference to the accompanying drawings.

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