



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.06.2009 Bulletin 2009/24

(51) Int Cl.:
E04B 1/74 (2006.01) E04B 2/80 (2006.01)

(21) Application number: **08170960.2**

(22) Date of filing: **08.12.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

- **Ryden, Birgitta**
260 70 Ljungbyhed (SE)
- **Lindqvist, Hans**
260 50 Billesholm (SE)
- **Wahlkvist, Anders**
260 50 Billesholm (SE)

(30) Priority: **07.12.2007 SE 0702719**

(74) Representative: **Cardin, Elise**
Saint-Gobain Recherche
39, quai Lucien Lefranc
93303 Aubervilliers Cedex (FR)

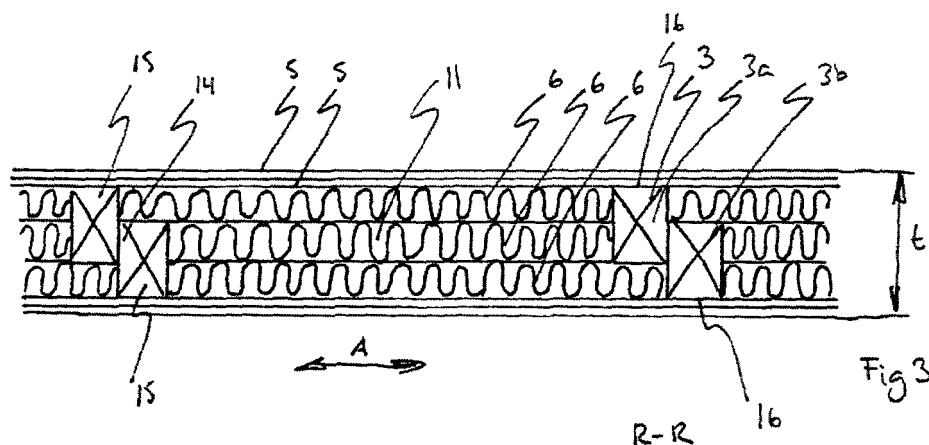
(71) Applicant: **Saint-Gobain Isover**
92400 Courbevoie (FR)

(72) Inventors:
• **Andersson, Leif**
24131 Eslov (SE)

(54) **Fireproof interior wall system**

(57) The invention relates to an interior wall system (1) comprising stud members (3) of wood or wood fibres, insulating material (6) and opposing linings (5). The linings (5) are supported by the stud members (3). Further an insulating material (6) is received in cavities (11) de-

fined by the stud members (3) and the linings (5). Each stud member (3) comprises two opposite end surfaces (16) which each make contact with a lining (5) and which are horizontally offset relative to each other parallel to the plane of extension (A) of the linings.



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a system for interior walls comprising stud members of wood or wood fibres, insulating material and opposing linings. In particular, the invention relates to a system for interior walls that should have good load bearing capacity in fire.

BACKGROUND ART

[0002] In the construction field there are many different ways of building houses. An increasingly common way in the Nordic countries is to build houses with a frame of wood studs, even when constructing multi-storey buildings. A problem when using frames of wood studs is, however, the load bearing capacity of the building in fire, that is the load bearing structure of the building must be able to resist fire without collapsing. Collapsing occurs due to the load bearing structure buckling as a consequence of the fire having reduced the load bearing capacity to such an extent that the permissible compressive stress, that is the dimensioned resistance to buckling, is exceeded. The construction simply does not manage to carry the loads imposed by floors above. The higher the building, the higher load bearing capacity of the building is required.

[0003] For instance, the frame of a house with up to four storeys must according to the Swedish building regulations (the Building Regulations of the Swedish Board of Building, Planning and Housing (BBR) 2006:12) be able to resist fire for at least 60 minutes to provide what is referred to as R60 rating, that is the load bearing capacity of the walls must be sufficient after 60 minutes of fire exposure. For houses with more than five storeys, the frame of the lowermost storeys must be able to resist fire for at least 90 minutes according to the above-mentioned building regulations.

[0004] Special requirements are placed on interior wall systems having a load bearing function, such as interior walls that are located in a flat. To provide R60 or R90 rating, such interior walls must be subjected to a test procedure involving a double-sided fire load, that is fire from two sides, according to the standard SS-EN 1365-4 entitled *Provning av brandmotstånd - bärande byggnadsdelar Del 4: Pelare* (in English: *Testing of fire resistance - load bearing construction members Part 4: Columns*). After that they can obtain the actual rating, which is provided according to the rating standard SS-EN 13501-1 entitled: *Brandteknisk klassificering av byggprodukter och byggnadselement - Del 1: Klassificering baserad på provningsdata från metoder som mäter reaktion vid brandpåverkan* (in English: *Fire resistance rating of building products and building elements - Part 1: Rating based on test data in methods measuring reactions during fire*).

[0005] Today's technology is generally used to build

an interior wall system with a frame of studs comprising a set of vertically arranged rectangular or square stud members of wood and which are usually supplemented with nogging pieces, which are also made of wood and which extend transversely between the stud members. The vertical sides of the frame of studs are then covered with lining sheets. The cavity defined by the frame of studs and the lining sheets can be filled with insulating material of a suitable type. The fire resistance of such an interior wall system depends on a plurality of parameters, of which the most important are the dimensions of the stud members, the wood quality of the stud members, the number of lining sheets, type of lining sheets, type of insulation and also the number of nogging pieces between two adjoining stud members.

[0006] A few different ways of building load bearing interior walls that are to resist double-sided fire load and that are R60 and R90 rated are described in Section 6.6.4 in "Brandsäkra trahus" (in English: *Fireproof wood houses*), Version 2 (ISBN 91-88170-30-6), published by Träteknik, (The Swedish Institute for Research in Wood Technology). The interior wall systems of the type mentioned in the above paragraph are described. A common feature of the different solutions suggested in this publication is the use of rectangular stud members with a cross-sectional dimension of 45X145 mm and two layers of plasterboard as lining sheets on each side of the interior wall system.

[0007] In fire, the frame of wood studs is primarily protected by the lining material, but when this is damaged, the frame of studs subjected to fire will be exposed from two directions. This results in gradual weakening of the load bearing capacity as the fire proceeds. The cross-section of the stud members, but also of the nogging pieces, will in fact be reduced, resulting in a reduction of the load bearing capacity. If the fire is allowed to proceed, the wall systems will finally collapse due to the fact that the stud members and the nogging pieces will quite simply buckle. When buckling occurs, it has been found that the interior wall system often collapses and falls down in the plane of extension of the wall, which is the weak direction.

[0008] One way of using today's technology to increase the load bearing capacity in fire is to increase the number of lining sheets. In that case, it takes longer for the fire to begin attacking the frame of wood studs, thereby achieving an increased fire resistance. A drawback of this method is that the floor surface occupied by the wall increases, thus providing a decreased living space. The most serious drawback is, however, the increased consumption of material and, thus, the increased building costs.

[0009] Another way of using today's technology to increase the load bearing capacity is to increase the dimensions of the rectangular stud members in the frame of studs which builds the wall, resulting in the stud members initially being larger in cross-section. This is unfavourable since it means that stud members with the

standard dimensions that are normally used in the building industry cannot be used any longer. This is not a very popular solution since a large number of houses are currently prefabricated and supplied in the form of building elements that are assembled on the building site. The element concept is based on the use of standard dimensions as much as possible to reduce the number of articles included in the production. A further drawback is that stud members of greater cross-sectional dimensions are more expensive than those of smaller cross-sectional dimensions. Consequently also this method increases the construction costs.

[0010] The load bearing capacity in fire can also be increased by using a larger number of nogging pieces between the vertical stud members. This too is a measure that makes construction more expensive.

OBJECTS OF THE PRESENT INVENTION

[0011] The object of the present invention therefore is to provide an interior wall system comprising stud members of wood or wood fibres which have an improved load bearing capacity in fire.

[0012] One object is that the interior wall system should be able to satisfy the current regulations for R60 or R90 rating according to the Building Regulations of the Swedish Board of Building, Planning and Housing (BBR) 2006: 12, SS-EN 1365-4 and SS-EN 13501-1.

[0013] Another object of the invention is that said interior wall system should be able to consist of parts which are already parts of standard dimensions in the building industry.

[0014] Yet another object is that the interior wall system should be able to have said load bearing capacity with a current standard wall thickness.

SUMMARY OF THE INVENTION

[0015] To achieve at least one of the above objects and further objects that have not been mentioned but that will appear from the following description, the present invention relates to an interior wall system comprising stud members of wood or wood fibres, insulating material and opposing linings, which linings are supported by the stud members and which insulating material is received in cavities defined by the stud members and the linings. The interior wall system is characterised in that each stud member comprises two opposite end surfaces which each make contact with a lining and which are horizontally offset relative to each other parallel to the plane of extension of the linings.

[0016] An interior wall system according to this construction has been found to have a greater load bearing capacity in fire than a conventional interior wall system. The primary reason is the construction of the stud members with two opposite end surfaces that are offset relative to each other. Seen in cross-section perpendicular to the longitudinal direction of the stud member, the mu-

tually offset end surfaces define a cross-section of the stud member which can be resembled to two projections coinciding in a central core portion. This core portion is, due to the contact of the end surfaces with the lining, initially not exposed to fire. Before the fire reaches the core portion, in fact first the end surfaces and the projections must be affected and reduced in cross-section. The core portion is, seen in the longitudinal direction of the stud member and along the major part of its circumference, protected by the insulating material that is placed in the cavity defined between the stud members and the linings. The insulating material may, depending on its filling ratio of the cavity, be arranged in such a manner that the stud member is freely exposed to fire only along its two opposite end surfaces. For a conventional rectangular stud member with the dimensions 145X45 mm, this exposed surface is about one third of the circumference of the cross-section, which is to be compared with about one fifth of a stud member according to the present invention if two studs with the dimensions 95X45 mm are used. As a result, the time it takes for the fire to reach and affect the central core portion to such a degree that its load bearing capacity is reduced to exceed the permissible compressive stress, that is dimensioned buckling resistance, will be delayed. Thus the fire resistance of the interior wall system increases.

[0017] The inventive interior wall system can easily be made up of materials and using dimensions of studs, lining panels and insulating material that are already standard in the building industry. The system can thus without problems be used in the existing manufacture of prefabricated building components.

[0018] Furthermore the inventive interior wall system can, by a suitable design of the individual stud member, have a greater load bearing capacity in fire than a conventional interior wall system without an increased width of the wall.

[0019] The stud members may consist of at least two member portions. These member portions may, as stated above, be arranged with their end surfaces offset relative to each other to form said stud members. The member portions should be joined to each other in such a manner that there is no play or gap between the member portions, whereby each stud member is to be considered a single body.

[0020] The stud members of the interior wall systems may comprise at least one central core portion having a width in the plane of extension of the lining that corresponds to the total width b of the end surfaces of the individual member portions, that is $B = b_1 + b_2 + \dots + b_x$. Alternatively, said width may be smaller than said total width, that is $B < b_1 + b_2 + \dots + b_x$. In the former case, the stud member may be made up of, for example, two or more conventional stud members which are arranged side by side in an overlap joint with their opposite end surfaces offset relative to each other. In the latter case, the stud member may consist of, for instance, an extruded, laminated or pressed wood-fibre-based structure or of two or more

conventional stud members which are connected to each other by recessed overlap joints.

[0021] The member portions may form a vertical connecting plane perpendicular to the plane of extension of said opposing linings. The actual connection may occur by means of different types of fasteners. For example screws, nails, plugs or bolts can be used, but it will also be appreciated that other fasteners that are suitable for the purpose can be used.

[0022] The member portions may consist of studs of rectangular cross-section. The studs may have the dimension 45X95 mm for instance, which dimension has been used for a long time and is a recognised standard dimension in the Swedish building industry.

[0023] In the cases where the member portions are rectangular in cross-section, their narrower width may constitute said end surfaces. With this design, that part of the stud members that is primarily exposed to fire is kept at a minimum, which delays the time before the central core portion is exposed. At the same time a central core portion may be formed, having a width, seen in the plane of extension of the lining, that exceeds the width of the individual stud member. The latter condition increases the load bearing capacity of the wall system in the normally seen weak direction which is parallel to the plane of extension of the wall.

[0024] The linings may consist of sheets or panels. These sheets or panels can be made of, for instance, gypsum, cement, wood, plywood, chips or wood fibres, or of combinations of these materials. Further convenient materials will easily be realised by a person skilled in the art. The dimensions are advantageously selected to be standard dimensions for cooperation with the distances between the stud members, which distances are standard distances as well. The number of layers may be varied to assist in further increasing the resistance to fire. The more layers, the better resistance to fire, but also the better bearing resistance of the wall in normal use.

[0025] The insulating material can be of the type that has high temperature resistance and good insulating capacity at high temperatures. Examples of such materials are rock wool or glass wool. An example of a suitable glass wool material is the one provided under the trademark Isover ULTIMATE®. Insulating materials with the above properties protect those parts of the frame of studs that are not directly exposed to fire. As a result, the frame of studs may resist fire for a longer period of time and have a continued good load bearing capacity also after a prolonged fire attack.

[0026] The interior wall system may further comprise nogging pieces which extend between the stud members. As a result, the load bearing capacity of the interior wall system is significantly improved. The number of nogging pieces and the location thereof affect the degree of improvement of the load bearing capacity.

[0027] The nogging pieces may, seen in a direction perpendicular to the plane of extension of the linings, be surrounded by the insulating material. As a result, also

the nogging pieces will be protected from the fire, which additionally increases the load bearing capacity of the interior wall system in fire. The nogging pieces are not directly exposed to fire and can act as buckle preventing means for the stud members and prevent them from buckling in the longitudinal direction of the wall. Experiments have demonstrated that the fractures occurring on stud members in interior wall systems that are built according to the invention mainly occur in a direction perpendicular to the plane of extension of the wall, that is in the normally seen rigid direction. In interior wall systems built according to prior art, fractures in the plane of the extension of the wall are the most common ones.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The invention will in the following be described in more detail by way of example with reference to the accompanying drawings, which illustrate a currently preferred embodiment.

[0029] Fig. 1 is a schematic side view of a portion of an interior wall system according to the invention.

[0030] Figs 2a-2d illustrate schematically four variants of cross-sections of some possible stud member constructions according to the invention.

[0031] Fig. 3 is a cross-section taken along the line R-R in Fig. 1.

[0032] Fig. 4 is a cross-section taken along the line Z-Z in Fig. 1

TECHNICAL DESCRIPTION

[0033] With reference to Figs 1 and 3, an embodiment of an inventive interior wall system 1 is schematically illustrated. The interior wall system 1, in the following referred to as system, comprises a stud frame which is made up of vertical stud members 3, horizontal nogging pieces 4 which extend between the stud members 3, linings 5 on both opposite sides of the system 1, and insulating material 6. For the sake of clarity, the front lining and parts of the insulating material are shown to be partially broken away.

[0034] The system 1 is intended to be used for load bearing interior walls in multi-storey buildings and will be described below starting from a straight wall. However, it will be appreciated that the system 1 is also applicable to walls having a different extension.

[0035] The stud members 3 are according to prior art technique placed along an imaginary straight line in the horizontal plane, that is in the plane of extension of the wall and its lining. A lower portion of each stud member 3 is attached to a lower horizontal stud 7 (sill) which in turn is attached to the floor 8. Correspondingly, an upper portion of each stud member 3 is attached to an upper horizontal stud 9 (capping) which in turn is attached to a ceiling 10.

[0036] The stud members 3, the nogging pieces 4 and the linings 5 together define closed, framework cavities

11 which accommodate the insulating material 6.

[0037] Special reference is now made to Fig. 2a, which is a cross-section of a possible embodiment of the individual stud member 3. The cross-section is taken transversely to the longitudinal direction of the stud member 3. In the shown embodiment, the stud member 3 is made up of two member portions 3a, 3b, each in the form of an elongate, vertically extending stud of rectangular cross-section. The two member portions 3a, 3b are closely joined to each other in an overlap joint 12 along the long side of the rectangular cross-section to form a vertical connecting plane 13 which extends perpendicular to the plane of extension of the linings, that is perpendicular to the plane of extension of the wall. The two member portions 3a, 3b are offset relative to each other in the vertical connecting plane 13, which means that the stud member 3 obtains a cross-section having a central core portion 14 from which extend two projections 15. The central core portion 14 is indicated by dashed lines. The projections 15 form two opposite end surfaces 16. The end surfaces 16 are formed of the short sides of the rectangular cross-section of the respective member portions 3a, 3b. The end surfaces 16 are adapted to make contact each with a lining, which linings will be described below. The end surfaces 16 are further, by the interconnection of the member portions 3a, 3b, horizontally offset relative to each other parallel to the plane of extension of the linings, see arrow A.

[0038] In the embodiment shown in Fig. 2a, the central core portion 14 has a width B in the plane of extension of the lining which corresponds to the total width b of the end surfaces 16 of the individual member portions 3a, 3b, that is $B=b_1+b_2$.

[0039] Special reference is now made to Fig. 2b, which illustrates an alternative embodiment in which the central core portion 14 has a width B in the plane of extension A of the lining that is smaller than the total width b of the end surfaces 16 of the individual member portions 3a, 3b, that is $B<b_1+b_2$. This is achieved by the two member portions 3a, 3b forming an overlap joint 12 which is recessed 17. Such a recessed overlap joint 12 may, as will be appreciated by a person skilled in the art, be provided in various ways with recesses in one or both member portions.

[0040] To form the inventive stud member 3, two member portions 3a, 3b are advantageously used. A person skilled in the art realises, however, that also three or more member portions can be assembled to form the stud member according to the present invention in accordance with the principles described above. This can occur according to the condition $B \leq b_1+b_2+\dots+b_X$, where X corresponds to the number of member portions.

[0041] If three or more member portions are used, they are arranged in accordance with the same principle as described above with mutually offset end surfaces in the plane of extension of the lining in order to form one or more central cores.

[0042] If two or more member portions are used to form

the stud members, they are attached to each other by suitable fasteners, for instance screws. It will be appreciated that also other types of fastener can be used, such as nails, plugs, bolts or glue.

[0043] The individual member portions 3a, 3b advantageously consist of conventional planed wood studs of rectangular cross-section, even if it will be appreciated that also other geometries or kinds can be used, such as square cross-section. The cross-sectional dimensions of the individual member portion 3a, 3b are preferably selected according to the standard dimensions that are used for wood studs in interior wall systems. In Sweden, for instance the dimensions 45X95 mm are used as standard.

[0044] When using rectangular member portions 3a, 3b, they are advantageously oriented in such a manner that the short sides b form said end surfaces 16. Furthermore they are advantageously arranged, see Fig. 2a, offset in the vertical connecting plane 13 in such a manner that the overlapping surface has a width in the thickness direction of the wall which corresponds to standard thicknesses of the insulating sheets that can be used for insulation of the system. If member portions of the dimensions 45X95 mm are used, an overlapping width c, see Fig. 2a, of 45 mm is advantageously used, whereby three insulating panels 6 of the standard thickness 45 mm can be arranged in the thickness direction t of the wall to fill the space between the linings, see Fig. 3.

[0045] It will also be appreciated that the same principle involving offset end surfaces 16 and a central core portion 14 can be obtained by laminating, pressing or extrusion of a wood-fibre-based material. An example of such an extruded stud member 3 is illustrated in Fig. 2c. Such a wood-fibre-based material may contain, for instance, a fire-resistant impregnation or finishing.

[0046] As an alternative to use of conventional wood studs as member portions, that referred to as lightweight studs with corresponding dimensions can be used, see Fig. 2d. A typical lightweight stud comprises a core of wood studs 19, 20 which are arranged on both sides of an insulation 21. The core is in turn covered with, for instance, plywood 18 on at least two opposite surfaces.

[0047] With reference once more to Fig. 1, the inventive system 1 may be used with or without nogging pieces 4. If nogging pieces 4 are used, they are arranged in a conventional manner so as to extend between two neighbouring stud members 3.

[0048] The attachment to the stud members 3 occurs by suitable fasteners, such as screws, nails and optionally brackets. In the embodiment shown in Fig. 1, two nogging pieces 4 extend between two neighbouring stud members 3, one at one third of the height of the wall and one at two thirds of the height of the wall. However, a person skilled in the art will realise that the number of nogging pieces and the positioning thereof can be varied. For example, only one nogging piece can be used between neighbouring stud members, and may then advantageously be arranged at half the height of the wall.

[0049] The nogging pieces 4 are advantageously arranged centred in the system, see Figs 1 and 4, that is aligned with the central core portion 14 which is formed by the stud members 3. Alternatively, one transverse nogging piece can be used, such as a vertical stud with the dimensions 45X145 mm. By transverse nogging piece is meant a nogging piece which extends between the linings in the thickness direction t of the wall. This solution, however, is less advantageous due to the extra consumption of material and more complicated mounting.

[0050] It will be appreciated that the load bearing capacity of the system is affected by the number of nogging pieces and their position. The greater the number of nogging pieces between neighbouring stud members, the higher the load bearing capacity.

[0051] The framework cavities 11 formed by the stud members 3 individually or in combination with the nogging pieces 4 are advantageously, wholly or partly, filled with some kind of insulating material 6. The insulating material 6 is advantageously a material having high temperature resistance and good insulating capacity at high temperatures. Examples of such materials are rock wool or glass wool. An example of the latter material is Isover ULTIMATE®.

[0052] The insulating material 6 can be applied in said cavities 11 in various ways. For example, the insulating material 6 can be injected into said cavities or arranged in the form of insulating panels.

[0053] If insulating panels are used, see Figs 3 and 4, they are advantageously selected to have standard dimensions, which are adjusted in width and thickness to standard dimensions of spaces between the components that make up an interior wall. If the stud members 3 consist of two member portions 3a, 3b which are arranged in the form of a central core portion 14 which is centred in the thickness direction t of the wall, three insulating panels 6 having the same thickness seen in the thickness direction of the wall are advantageously used, thus allowing the entire cavity 11 between stud members 3, nogging pieces 4 and linings 5 to be filled with said insulating panels. The insulating panels are pushed in place in the framework construction.

[0054] Finally linings 5 are mounted on opposite sides of the wall. The linings 5 are arranged to abut against and be attached to said end surfaces 16 of the stud members 3. The linings can be sheets or panels of materials such as gypsum, cement, wood fibre, plywood or chips.

[0055] Here too linings of standard dimensions are advantageously used, which means that they will fit to be attached to the stud members, which are also arranged in a standard spaced-apart relationship.

[0056] The actual attachment occurs with the aid of suitable fasteners, such as screws, nails or glue.

[0057] An individual sheet or panel can advantageously be arranged over three stud members arranged in succession, for extra stability of the system.

[0058] In the embodiment described in Figs 1, 3 and

4, the linings 5 consist of two layers. However, it will be appreciated that the number of layers can be varied. The number of layers and their thickness affect the time it takes for the fire to reach the stud members and, thus, the fire resistance of the system. Moreover, the number of layers and the thickness of the layers affect the general stability of the system during its normal use and life.

[0059] The progress of fire in a system according to prior art technique will be described below, after which a corresponding situation is described for the inventive system. The description will be based on a fire situation when the system is attacked from two directions, in accordance with that applicable for testing according to SS-EN 1365-4. The comparison is based on a system according to prior art technique which uses stud members of rectangular cross-section and a system according to the present invention, in which the stud member is made up of two member portions of rectangular cross-section. In both systems, the end surface in contact with the lining has the same width.

System according to Prior Art

[0060] A system which is made up according to prior art technique comprises a frame of studs consisting of a set of vertically arranged individual stud members of rectangular cross-section which are supplemented with nogging pieces extending between the stud members. The vertical sides of the frame of studs are coated with lining sheets, and the cavities which are defined by the stud members, the nogging pieces and the lining sheets are filled with insulating material.

[0061] In a fire, the lining sheets which can be said to constitute a protective casing for the stud frame of the system are initially attacked. As the lining sheets give in, the entire stud frame will be attacked, that is the stud members as well as the nogging pieces, from two opposite sides. This means that these are reduced in cross-section from two directions due to the fire. Since the stud member has a homogeneous width throughout its cross-section, this quickly results in a weakening. In consequence, after being affected by the fire for a while, one or more stud members lose their load bearing capacity that is the load imposed by the floors above which are supported by the vertical stud members will finally exceed the dimensioned compressive stress of the stud members, often referred to as critical load or buckle load. One or more stud members simply collapse by buckling. Basically buckling occurs according to a combination of Euler's 2nd and 4th buckling case. Euler's 2nd buckling case refers to a situation involving an articulated rod. Euler's 4th buckling case refers to a situation involving a rod which is fixedly attached at both ends. A system of this construction usually has difficulty in meeting the requirements that are applicable to R90 rating according to SS-EN 13501-1 without various reinforcements in the form of, for example, an increased number of nogging pieces and an increased number of lining layers.

System according to the Invention

[0062] The inventive system, see Figs 1 and 3, and its stud member construction provide an entirely different surface exposed to the fire. This means a lengthening of the time that is required for the progress of fire to affect the stud members 3 to such an extent that the dimensioned compressive stress of the stud members is exceeded and the stud member collapses. The lengthening of time has proved to be so good that a system of the construction in question satisfies the requirements that are applicable to R90 rating according to the above-mentioned SS-EN 13501-1.

[0063] More specifically, the individual stud member 3 has, when the lining 5 has given in, a surface (the end surface 16 facing the lining 5) which certainly initially is of the same size as in prior art. This is true as long as merely the respective projections 15 are exposed to fire.

[0064] If the stud member 3 is designed according to the embodiment as shown in Fig. 2a, the two projections 15 together have a mass volume which is identical to that of a conventional rectangular stud member measured over a corresponding distance in the thickness direction of the wall. The great difference, however, lies in the fact that inside these projections 15 there is in the inventive system a central core portion 14 which itself has the same mass volume as the two projections 5 have together. As long as merely the projections 15 are exposed to fire, this central core portion 14 is intact.

[0065] In addition, the central core portion 14 is insulated against fire by being protected in the insulating material 6 which fills the cavity 11 in the framework construction defined between the stud members 3, the nogging pieces 4 and the linings 5. Also the nogging pieces 4 are insulated against fire, see Fig. 4, since they can be aligned with the central core portion and, thus, not be exposed to fire until late in the progress of fire.

[0066] With the construction of the stud member 3 as shown in Fig. 2a, which is made up of two rectangular portion members 3a, 3b, basically one fifth of the circumference of the cross-section is initially exposed to fire while the remaining four fifths are surrounded by the insulation 6, see Fig. 3. The stud member 3 is freely exposed to fire only along its two opposite end surfaces 16. This should be compared to a stud member according to prior art which consists of an individual stud of rectangular cross-section and which is exposed to fire along one fourth of the circumference of the cross-section in the case where a comparison is made with a stud having the dimensions 145X45 mm.

[0067] The construction of the stud member thus allows cooperation with the insulation to obtain good enclosure of the "load bearing" central core, which further helps to improve the fire resistance.

[0068] Taken together, the inventive system involving a thus designed stud member means that the resistance to fire increases and that the system meets the requirements that are applicable to R90 rating according to SS-

EN 13501-1 as stated above.

[0069] Practical experiments with a system of stud members which are made up of two member portions with the dimensions 45X95 mm, three layers of insulating sheets each having a thickness of 45 mm of the trademark Isover ULTIMATE® arranged in the thickness direction of the wall in combination with a lining in the form of double fireproof gypsum boards, each having a thickness of 15 mm, resisted a double-sided fire load according to SE-EN 1365-4 for 107 minutes before the system collapsed. This is a duration which well exceeds the 90 minutes that are required for R90 rating according to SS-EN 13501-1. In the experiment, use was made of two nogging pieces with the dimensions 45X95, which were arranged upright, that is the short side in cross-section facing upwards.

[0070] The experiments were performed with a load of 25kN per stud, which is at least twice as much as that of a stud with the dimensions 145X45 mm in a corresponding conventional stud wall that manages the R90 rating, which is evident from the report "Brandsäkra trahus" (in English: Fireproof wood houses), Version 2 (ISBN 91-88170-30-6), published by Trätek.

[0071] It is noteworthy that the tested system collapsed due to buckling in the normally seen rigid direction of the wall, that is perpendicular to the plane of extension of the wall. Systems according to prior art in fact tend to collapse in the weak direction, that is parallel to the plane of extension of the wall.

[0072] In the embodiments described above, the system 1 has been described to comprise nogging pieces 4. It will be appreciated that the nogging pieces can be excluded, or used in a different number, according to the desirable load bearing capacity.

[0073] Moreover it will be appreciated that the lining may be varied, both in number of layers and thickness.

[0074] Building regulations are frequently national, which means that each country has its own requirements as to choice of materials, permissible loads, testing methods etc. Moreover, a country frequently has its own standard dimensions. The description above is based on the rules and standard dimensions that are currently applicable in Sweden. However, it should be emphasised that the principle of the inventive system is applicable also to other dimensions, rules and choice of materials. It will thus be appreciated that the present invention is not limited to the embodiments described above. Several modifications and variations are conceivable, and therefore the scope of the present invention is exclusively defined by the appended claims.

Claims

1. An interior wall system adapted to withstand double-sided fire load comprising stud members (3) of wood or wood fibres, insulating material (6) and opposing linings (5), which linings (5) are supported by the

stud members (3) and which insulating material (6) is received in cavities (11) defined by the stud members (3) and the linings (5), **characterised in that** each stud member (3) comprises two opposite end surfaces (16) which each make contact with a lining (5) and which are horizontally offset relative to each other parallel to the plane of extension (A) of the linings (5).

2. An interior wall system as claimed in claim 1, in which each stud member (3) consists of at least two member portions (3a, 3b). 10
3. An interior wall system as claimed in claim 1 or 2, in which each stud member (3) comprises at least one central core portion (14) having a width (B) in the plane of extension (A) of the lining (5) that corresponds to the total width (b) of the end surfaces (16) of the individual member portions (3a, 3b), that is $B=b_1+b_2+\dots b_x$. 15 20
4. An interior wall system as claimed in claim 1 or 2, in which each stud member (3) comprises at least one central core portion (14) having a width (B) in the plane of extension (A) of the lining (5) that is smaller than the total width (b) of the end surfaces (16) of the individual member portions (3a, 3b), that is $B<b_1+b_2+\dots b_x$. 25
5. An interior wall system as claimed in claim 4, in which the member portions (3a, 3b) form a vertical connecting plane (13) perpendicular to the plane of extension (A) of said opposing linings (5). 30
6. An interior wall system (1) as claimed in claim 4 or 5, in which the member portions (3a, 3b) consist of studs of rectangular cross section. 35
7. An interior wall system (1) as claimed in claim 6, in which the narrower width (b) of the member portions (3a, 3b) constitutes said end surfaces (16). 40
8. An interior wall system as claimed in any one of the preceding claims, in which the linings (5) consist of sheets or panels. 45
9. An interior wall system as claimed in any one of the preceding claims, in which the insulating material (6) has high resistance to temperature and good insulating capacity at high temperatures. 50
10. An interior wall system as claimed in any one of the preceding claims, further comprising nogging pieces (4) which extend between the stud members (3). 55
11. An interior wall system as claimed in claim 10, in which nogging pieces (4), seen in a direction perpendicular to the plane of extension (A) of the linings

(5), are surrounded by the insulating material (6).

12. An interior wall system as claimed in any of the preceding claims, in which the stud members (3) consist of at least two member portions (3a, 3b,) each member portion (3a, 3b) displaying a rectangular cross-section, whereby a central core portion (14) is formed by said at least two member portions (3a, 3b), whereby the width of the core portion (14) in the extension plane (A) of the linings (5) exceeds the width of the the individual member portion (3a, 3b) in the extension plane of the linings (5).

