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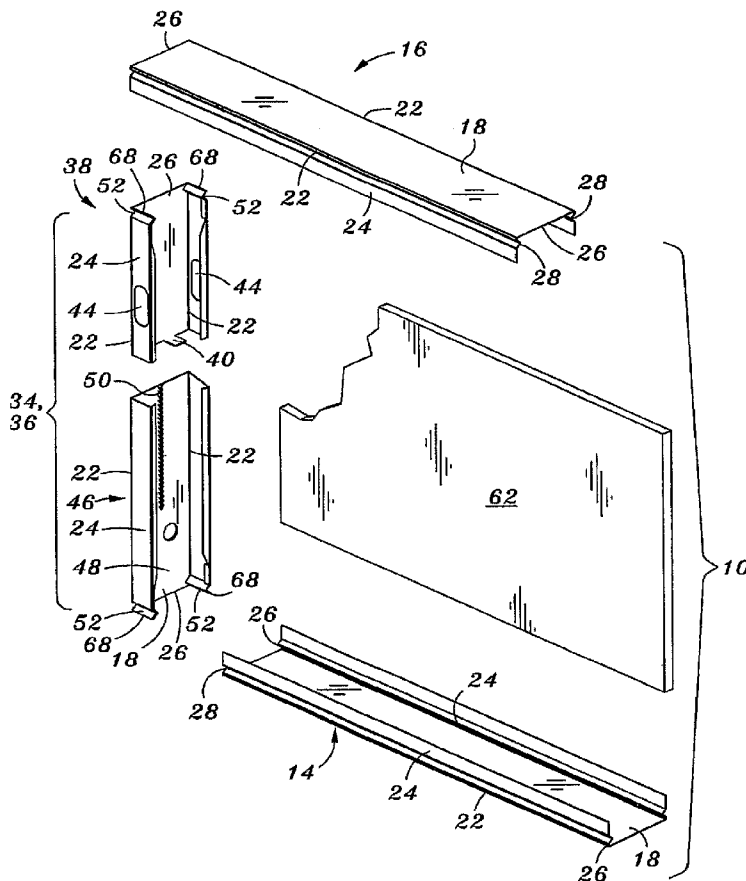
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(54) Title: FIRE RATED WALL STRUCTURE



(57) Abstract: A fire rated wall structure includes a channel-shaped top track and bottom track each having male protrusions formed along their side walls. The wall structure further includes at least one stud member interconnecting the top and bottom tracks. The stud member comprises a stationary portion and a slip extension slidably nested within the stationary portion. Female recesses are formed in a terminus end of each of the slip extension and stationary portion and are adapted to nest with male protrusions of the top and bottom tracks. A slot formed within the slip extension accommodates fasteners initiated from a panel member and which passes through the stationary portion side wall and extends into the slot to allow relative sliding motion between the slip extension and the stud member. A top overcap disposed in overlapping relation to the top track includes a male protrusion for slidingly bearing against the panel member.

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**FIRE RATED WALL STRUCTURE****CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of U.S. Provisional Application No. 60/780,099, entitled "FIRE RATED WALL STRUCTURE" filed on March 8, 2006, and is related to pending U.S. Patent Application No. 09/979,214, filed May 14, 2002, entitled "STRUCTURAL MEMBERS AND JOINING ARRANGEMENTS THEREFOR", and U.S. Patent Application No. 11/146,534, filed June 7, 2005, entitled "STRUCTURAL MEMBERS WITH GRIPPING FEATURES AND JOINING ARRANGEMENTS THEREFOR", the entire content of each being expressly incorporated by reference herein.

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**BACKGROUND**

The present invention relates generally to joining systems and, more particularly, to a uniquely configured fire rated wall structure that may be used in the construction of wall assemblies such as partitioning walls and non-loading bearing curtain walls and which is specifically adapted to meet fire rating provisions found in many building codes.

In building construction, conventional wall fabrication techniques employ the use of upper and lower headers that are disposed in spaced relationship to one another. The upper and lower headers are attached to the ceiling and floor portions of a building structure and are interconnected with a plurality of stud members disposed in spaced, parallel relationship to one another. The stud members are typically connected to the top and bottom headers with mechanical fasteners such as nails, screws and the like. The framing, which is comprised of the upper and lower headers and the stud members, may be of wooden or metallic construction. Panels such as drywall, gypsum board, sheetrock, and the like are then installed on opposing sides of the framing in order to complete the basic wall structure. Unfortunately, traditional wall construction suffers from several drawbacks include the time-consuming nature of such traditional wall construction methods and resultant high costs.

Metallic framing systems typically employ the use of lightweight steel stud members which are generally channel shaped or U-shaped. The stud members are attachable at opposing ends to horizontally oriented top and bottom plate members. The top and bottom plate members are, in turn, secured to the building structure adjacent the ceiling and floor. In this regard, a metallic framing system comprises a series of spaced apart steel stud members engaged to the top and bottom plate members and which includes wall board which is attached to opposing sides of the metallic framing system.

In conventional construction methodology, the frames may be assembled on the ground with the top and bottom plate members being disposed in spaced apart relationship. The stud members are then connected to the top and bottom plates by engaging the ends of the stud with screws or other suitable fasteners. Because the metallic framing system is dependent upon fasteners for interconnecting the stud members to the top and bottom plate members, the framing system is generally structurally weak when the stud members are initially engaged to the top and bottom plate members prior to fastener installation. The framing system does not achieve full strength until the wall board is affixed to the frame and therefore provides insufficient rigidity until fasteners are inserted.

Another method of securing the stud members to the top and bottom plates involve the use of a tab and slot arrangement wherein tabs disposed on extreme ends of the top and bottom plates engage corresponding slots in the stud members. Such engagement is facilitated by manually urging (i.e., with a hammer) the tabs so that they are reoriented at an angular orientation relative to the stud members which thereby locks the stud members against the top and bottom plates. Unfortunately, such method of interconnecting the stud members to the top and bottom plates requires additional material to form the top and bottom plates. Furthermore, the reorienting or bending of the tabs into the locking position requires additional labor and is therefore relatively time consuming. Although the tab and slot method of connecting the stud members to the top and bottom plates is generally effective in securing such members, the amount of time required to bend the tab a total of four times for each stud member represents a significant drawback which detracts from the overall utility of this type of metallic framing system.

Another method of constructing a metallic framing system from stud members and top and bottom plates involves the use of cooperating formations in each of the components. The formations consist of a securing notch formed in the walls of the mating stud member and plates. In order to facilitate the positioning of the stud member, the walls of the plate members include an upturned lip formed at a location where the stud member mates with the top and bottom plate members. Unfortunately, the additional materials required to form such lip increases overall material costs and necessitates the use of a securing clip which further adds to labor and assembly costs. Another drawback associated with such methodology of connection is the low strength of the framing system due to the minimal amount of engagement between the mating components. More specifically, the limited engagement between the mating components minimizes the overall resistance of the framing system to rotation, twisting and separation of the stud member and top and bottom plate members.

Another problem associated with prior art metallic framing systems is a result of irregularities in floor-to-ceiling heights. More particularly, in building construction, poor concrete finishing and/or irregularities in the height of the ceiling structure necessitates the time-consuming task of cutting and fitting individual stud members to fit between the top and bottom plates mounted to the ceiling and floor. Ideally, the spacing between the floor and the ceiling structure is constant such that the stud members may generally be of the same length. However, irregularities in spacing often occur such that the stud members must be custom fit. Furthermore, windows and/or doors installed in many wall structures require that the stud members must be cut and fit on a trial-and-error basis to accommodate the specific window sizes and door sizes.

Although prior art joining method as described above generally result in a functionally-adequate metallic framing system, such prior art joining systems suffer the significant deficiency of being time-consuming and tedious to assemble. Furthermore, the nature of tab and/or slot joining systems limit the engagement of studs to predetermined positions along the upper track. This limiting feature is unacceptable in many applications such as, for example, in dry wall fit-outs which require unrestricted positioning in order to allow tradesman to overcome often encountered but unforeseen measurement discrepancies. Such measurement discrepancies may be the result of rough and inaccurate pouring of concrete walls.

In addition, prior art joining systems suffer another significant deficiency regarding impracticality for applications having varying ceiling-to-floor measurements. In such situations, the studs with joining ends are typically produced in runs (i.e., set quantities) of predetermined lengths such that variations in ceiling height render such studs unusable. Furthermore, in prior art building methods, set-length studs having joining ends are unsuitable for use due to ceiling height variations as was previously noted. Because such studs are custom-fit studs and have no self-joining mechanisms, tradesman endure the tedious and time-consuming task of connecting such individual studs to the top and bottom tracks as is required for structural integrity of the wall and which is also necessary to allow fitting of electrical wiring, etc.

Unfortunately, when fitting wiring, studs can become dislodged from their original positions. In the case of fire rated walls of the prior art, the top track typically incorporates flanges that are longer than standard in order to trap the engaged studs. The studs are intentionally cut short in order to allow for upward expansion of the stud when exposed to heat as well as to allow downward contraction or movement. Unfortunately, such a system does not allow for relative movement between the studs and track. As such, the studs must be left unfastened and are only supported between the track flanges which results in a relatively weak wall structure that must rely heavily upon the wallboard for load-carrying support. Furthermore, the studs are often temporarily connected much like standard wall construction in order to allow for the fitting of electrical wiring and other utilities.

Metallic framing systems of the prior art suffer from an additional drawback associated with fire rating for interior walls. More particularly, many building codes include fire rating provisions wherein interior portions of the building must be capable of containing heat, smoke and flames of a fire. In this regard, the wall structure is preferably constructed in such a manner as to prevent the migration of heat, smoke and flames to an adjacent room or rooms. The migration of smoke, heat and/or flames may compromise the safety of occupants and/or personal property in an adjacent room. Fireproof ratings are defined in terms of duration or time that a wall must be capable of containing the fire and its effects from migrating to an adjacent part of the building. Typical fire ratings may be expressed in terms of time increments such as one hour, two hours, four hours and upward and are typically

imposed on certain areas of building structures including wall structures fabricated with metallic framing systems.

One deficiency associated with the fire rating of wall structures fabricated with metallic framing systems is that the metallic structure typically expands under heat in an amount that is disproportionate to the amount that wall board expands under the same heat. The disparity in expansion between the metallic framing system and the wall board covering the framing system can result in the creation of cracks or gaps in the wall structure. Such gaps may occur at the joint between the ceiling and the wall structure or at other location on the wall structure. Gaps may also occur due to fracturing or crumbling of the wall board as the metallic framing stretches the wall board.

The differences in expansion of the metallic framing system and the wall board is the result of differences in coefficient of thermal expansion. More particularly, because metal has a greater coefficient of thermal expansion than wall board, an increase in the temperature of the room causes the metallic framing in the vertical stud members to expand to a greater extent than the expansion of the wall board. A further deficiency associated with conventional wall structures is the rigid or non-adaptive nature of the wall structure to changes in ceiling height as a result of settling of the building foundation and/or building movement such as may be caused by seismic activity or creeping of load-carrying beams over time. The same drawbacks described above associated with relative movement between the framing system and the wall board is present in ceiling movement or building settling.

As can be seen, there exists a need in the art for a wall structure which employs the use of metallic framing and which is specifically configured to provide a desired fire rating despite differences in the mechanical properties (i.e., coefficient of thermal expansion) of the components that make up the wall structure. More specifically, there exists a need in the art for a fire rated wall structure which includes an expansion joint that allows the metallic framing underlying the wall structure to move dynamically in response to heat and/or building movement without compromising the integrity of the wall board which covers the steel frame such that noxious fumes, smoke, flames and/or heat from a fire cannot migrate through voids or cracks created in the wall board. Finally, there exists a need in the art for a fire rated wall structure and, equally importantly, a fire rated wall structure that incorporates a

self-fastening mechanism which allows for quick and economical assembly of the wall structure with minimal skill and which can accommodate irregularities in floor and/or ceiling height.

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#### BRIEF SUMMARY

The above-mentioned deficiencies and drawbacks associated with steel framing systems of the prior art are specifically addressed and alleviated by the fire rated wall structure of the present invention. More particularly, the wall structure of the present invention includes an expansion joint which allows for relative vertical movement of the metallic components of the steel framing and the non-metallic panel member that is secured to the steel framing.

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In its broadest sense, the wall structure includes a top and bottom track and at least one stud member. The top and bottom tracks are preferably disposed in spaced and parallel relation to one another and may be mounted to a floor and a ceiling of a building. At least one of the stud members is interconnected to the top and bottom tracks. As is well known in the building construction arts, stud members are generally provided in spaced intervals along the top and bottom track in order to provide a means for connecting the panel members such as drywall to the wall structure.

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Each of the top and bottom tracks generally has a channel shaped cross section with opposing terminus ends. Furthermore, each one of the top and bottom tracks comprises a planar web defined by a pair of opposing longitudinal edges. A pair of opposing and inwardly directed male protrusions is integrally formed with and extends continuously along respective ones of the longitudinal edges. The male protrusions preferably have a V-shaped cross section. Each of the top and bottom tracks additionally comprises a pair of substantially flat side walls which are preferably integrally formed with and which extend outwardly from a respective one of the male protrusions. The side walls are preferably oriented perpendicularly relative to the web. In addition, the top and bottom tracks are preferably oriented such that the side walls thereof face one another.

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The stud member of the wall structure may be adapted to be transversely interconnected to the top and bottom tracks and is generally oriented in perpendicular relationship thereto. Similar to the configuration of the top and bottom tracks, the stud member may also have a channel shape cross-section with an opposing pair of

terminus ends. Importantly, the stud member includes a telescopic mechanism comprising a slip extension slideably engaged to a stationary portion. In this regard, the stud member comprises the slip extension and the stationary portion. As was earlier mentioned, the telescopic mechanism is adapted to allow for changes in the length of the stud member. More particularly, the telescopic mechanism allows the stud member to be either lengthened or shortened in order to accommodate changes in spacing occurring between the top and bottom tracks in the installed wall structure. Such changes may occur during differential heating and/or cooling of the metallic structure comprised of the top and bottom tracks and stud member and the non-metallic nature of the panel member, typically comprised of drywall and/or gypsum board and the like.

Each of the slip extension and stationary portion preferably has a channel shaped cross-section with opposing terminus ends. Specific features are incorporated into at least one of the terminus ends of each the slip extension and stationary portion to facilitate engagement with the top and bottom tracks. More specifically, at least one of the terminus ends of the slip extension and stationary portion includes a pair of opposed and inwardly directly female recesses formed in side walls of the slip extension and stationary portions. Each female recess preferably has a V-shaped cross-section formed complementary to the V-shaped cross-section of the male recesses. In this manner, the female recesses are adapted to receive a respective one of the male protrusions formed in the top and bottom tracks. Mechanical fasteners may additionally be installed in order to interconnect terminus ends of the stud member to the top and bottom tracks. Furthermore, the web of the stationary portion may include at least one opening sized and configured to accommodate a utility conduit to provide a means to route electrical wiring, plumbing, and the like through the wall structure.

The wall structure may further comprise an elongate top overcap secured in abutting relationship to the top track. The top overcap preferably has a channel shaped cross-section including a substantially flat planar web with planar side walls extending perpendicularly outwardly from the web. A pair of opposing male protrusions are preferably integrally formed in respective ones of the side walls of the top overcap. The male protrusions extend continuously along a length of the side walls and are preferably configured with a V-shaped cross-section. The top overcap

is preferably configured such that at least one of the side walls thereof at least partially overlaps the top track side wall and is disposed in spaced relation thereto. Ideally, the top overcap is configured such that the male protrusion is disposed in contacting relationship to an outer surface of the panel member in order to provide sealing engagement therewith. The top overcap is preferably configured as a unitary structure wherein the web, side walls and male protrusions are integrally formed.

Importantly, the stud member is configured to allow for expansion and contraction of the wall structure due to the inclusion of a slot formed in the slip extension. More specifically, the slot is formed in at least one of the side walls of the slip extension and is configured to allow a fastener to extend thereinto such that relative sliding motion between the slip extension and the stationary portion may freely occur. A panel member may be connectively mounted to the bottom track and a stationary portion. Importantly, the panel member is also disposed in non-connective overlapping relationship to the slip extension and to the top track in order to provide relative movement thereof between the panel member and the slip extension and top track.

In this regard, the panel member may be secured to the wall structure through the use of a plurality of fasteners extending into the side walls of the bottom track and stationary portion. At least one of the fasteners extends through the panel member and into the stationary portion side wall and passing through the slot. As was earlier mentioned, the slot formed in the slip extension allows for relative sliding motion between the slip extension and the stud member such that the stud member may be lengthened and shortened to accommodate changes in spacing between the top and bottom tracks. Such spacing changes may occur due to heating caused by a fire and as a result of differences in coefficient of thermal expansion between the metallic components (i.e., comprised of the top and bottom tracks and stud member) and the non-metallic components (i.e., the panel member).

#### BRIEF DESCRIPTION OF THE DRAWINGS

These as well as other features of the present invention will become more apparent upon reference to the drawings wherein:

Figure 1 is a perspective view of a fire rated wall structure of the present invention and illustrating a stud member disposed on an end thereof;

Figure 2 is a perspective view of the wall structure and illustrating a top track, a bottom track, and the stud member comprised of a slip extension and a stationary portion and further illustrating a panel member secured to the bottom track and stationary portion;

5           Figure 3 is an exploded perspective view of the wall structure illustrating the interconnectivity of the stud member, the top and bottom tracks and the panel member;

10           Figure 4 is a side view of the wall structure taken along the lines 4-4 of Figure 3 and illustrating the attachment of the slip extension and stationary portion to the top and bottom tracks and further illustrating fasteners securing the panel member thereto;

            Figure 5 is a plan view of a portion of the wall structure showing a slot formed in the slip extension and illustrating a fastener extending through the stationary portion of the stud member and entering the slot in an overlapping portion of the stud member;

15           Figure 6 is a partially exploded perspective view of the wall structure and further illustrating a top overcap mounted in overlapping relationship to the top track;

            Figure 7 is a partially exploded perspective view of the wall structure illustrating a stud overcap as may be mounted on the stud member;

20           Figure 8 is an enlarged partial side view of the top overcap mounted on the top track and illustrating a gap formed between an upper edge of the panel member and the top overcap;

            Figure 9 is an enlarged partial side view of the wall structure illustrating the top overcap having a pair of V-shaped male protrusions which are configured to sealingly bear against the panel member;

25           Figure 10 is a perspective view of the wall structure illustrating the interconnectivity of the stud overcap mounted to the stud member and further illustrating an aperture formed in a side wall of the stud overcap and through which a fastener may extend;

30           Figure 11 is a partial plan view of the wall structure illustrating the stud overcap and the relative positioning thereof upon a stud member and further illustrating the relative positioning of the aperture of the stud overcap with respect to the slot formed in the slip extension; and

Figure 12 is a side view of the wall structure and illustrating the relative positioning of the stud overcap with respect to the slip extension and stationary portion of the stud member.

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#### DETAILED DESCRIPTION

Referring now to the drawings wherein the showings are for purposes of illustrating various aspects of the present invention and not for purposes of limiting the same, shown in the figures is a fire rated wall structure 10 which is specifically adapted to compensate for expansion or retraction in the overall height of the wall structure 10 such as may occur when the wall structure 10 is heated due to a fire occurring within a building. Advantageously, the wall structure 10 of the present invention allows for relative sliding movement between a panel member 62 covering the wall structure 10 and an upper portion of the steel frame against which the panel member 62 is abutted. In this manner, the upper portion of the wall structure 10 may expand in relation to the panel member 62.

Referring more particularly to Figures 1-3, shown in perspective is the fire rated wall structure 10 having the essential components illustrated therein. More particularly, the wall structure 10 broadly comprises a top track 16 and a bottom track 14 disposed in spaced parallel relation to one another. Figures 1-3 further illustrate a single stud member 34 oriented transversely to the top and bottom tracks 16, 14 and interconnecting such top and bottom tracks 16, 14. Although a single stud member 34 shown in Figures 1-3, it should be noted that as is typical in wall construction practices, a plurality of stud members 34 are typically spaced on center along the top and bottom tracks 16, 14 at pre-determined intervals such as at 16" and 24" intervals. Advantageously, due to the unique structural features provided in opposing terminus ends 26 of the stud member 34 as well as the mating features formed within each of the top and bottom track 16, 14 members, the stud members 34 may be conveniently located at any position along the top and bottom track 16, 14 members.

The specific interconnection of the stud member 34 with the top and bottom tracks 16, 14 is shown and described in commonly-owned U.S. Patent Application No. 09/979,214, entitled "Structural Members and Joining Arrangements Therefore," and commonly-owned U.S. Patent Application No. 11/146,534, entitled "Structural Members with Gripping Features and Joining Arrangements Therefore," the entire

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contents of each being expressly incorporated by reference herein. More specifically, the above-mentioned commonly-owned patent applications disclose the above-described features which are formed on the terminus ends 26 of the stud member 34 as well as certain mating features formed along side walls 24 of the top and bottom tracks 16, 14, the stud members 34 may be initially engaged to the top and bottom tracks 16, 14 without the use of fasteners 64 such as screws. Thereafter, upon alignment and positioning of the stud members 34 to the desired location, fasteners 64 may be extended through side walls 24 of the top and bottom tracks 16, 14 and stud members 34 in order to permanently connect such components.

As may be appreciated, the wall structure 10 of the present invention may be adapted for fabrication of various types of building walls such as partitioning walls and non-load bearing curtain walls. However, various other types of walls may be constructed using the wall structure 10 of the present invention. In this regard, the top and bottom tracks 16, 14 may each be adapted to be positioned along a surface such as along respective ones of a floor and a ceiling. As was earlier mentioned, the top and bottom tracks 16, 14 are preferably disposed in spaced parallel relation to one another wherein each of the top and bottom tracks 16, 14 has a channel shaped cross-section with opposing terminus ends 26. More specifically, each one of the top and bottom tracks 16, 14 comprises a planar and substantially flat web 18 which is defined by a pair of opposing, parallel longitudinal edges 22.

A pair of opposing, parallel and inwardly directed male protrusions 28 are integrally formed with and extend continuously along respective ones of the longitudinal edges 22. Although the male protrusions 28 may be provided in any cross-sectional shape, each of the male protrusions 28 preferably has a V-shaped cross-section as best seen in Figure 4. In this regard, each of the male protrusions 28 is comprised of upper and lower inclined surfaces 30, 32 that collectively form the V-shaped notches. In addition, each of the top and bottom tracks 16, 14 further comprises a pair of substantially flat and planar side walls 24 which are preferably integrally formed with and which extend outwardly from a respective one of the male protrusions 28. As can be seen in Figure 4, the side walls 24 are generally oriented in perpendicular relation to the web 18.

Regarding the relative orientation of the top and bottom tracks 16, 14, as shown in Figures 1-4 and 10, the top and bottom tracks 16, 14 are oriented such that

the side walls 24 of the top tracks 16 face toward the side walls 24 of the bottom track 14. In this orientation, the stud member 34 may be conveniently installed within the channel shaped cross-sections of the top and bottom tracks 16, 14. As was earlier mentioned, the stud member 34 is adapted to be transversely interconnected to the top and bottom tracks 16, 14 and is preferably disposed in perpendicular relation thereto although the stud member 34 may be oriented in any angular orientation with respect to the top and bottom tracks 16, 14. Like the top and bottom tracks 16, 14, the stud member 34 also has a channel shaped cross-section with an opposing pair of terminus ends 26.

As best seen in Figure 3, the stud member 34 includes an expansion joint 12 in the form of a telescopic mechanism 36 which is comprised of a slip extension 38 which is at least partially nested and slideably received within a stationary portion 46. In this regard, both the slip extension 38 and stationary portion 46 comprise the stud member 34. Due to the slideable nature of the slip extension 38 within the stationary portion 46, the stud member 34 is adapted to allow for changes in length of the stud member 34. More specifically, the telescopic mechanism 36 is adapted to allow the stud member 34 to be lengthened or shorted in order to accommodate changes in spacing between the top and bottom tracks 16, 14. As was earlier mentioned, such changes in spacing may occur due to heating of the wall structure 10 which in turn results in heating and expansion of the metallic framing comprised of the top and bottom tracks 16, 14 and stud members 34.

In this regard, such heating of the wall structure 10 results in a differential in the amount with which the metallic wall structure 10 increases in length with respect to the increase in length of the panel member 62 covering the metallic wall structure 10. As is well known, the coefficient of thermal expansion of metal is different than the coefficient of thermal expansion of wall board materials from which the panel member 62 is constructed. More specifically, commonly used panel members 62 such as drywall and gypsum board have a much lower coefficient of thermal expansion. Therefore, upon heating of the wall structure 10, the metallic structure increases at a greater length than the panel member 62. The inclusion of the telescopic mechanism 36 in the stud member 34 accommodates such differential heating such that the metallic structure can increase in length while the panel member 62 remains

permanently affixed to a lower portion of the wall structure 10 and is only slideably disposed against an upper portion of the wall structure 10.

Referring more particularly now to Figures 1-5, shown is the stud member 34 comprised of the slip extension 38 and stationary portion 46. As was earlier mentioned, the slip extension 38 is specifically configured to be slideably received within the stationary portion 46. Each one of the slip extension 38 and stationary portions 46 is constructed with a channel shaped cross-section and each has opposing terminus ends 26. One of the terminus ends 26 of the slip extension 38 is adapted to be secured to the top track 16. Likewise, one of the terminus ends 26 of the stationary portion 46 is adapted to be secured to the bottom track 14. However, the above-recited arrangement of the slip extension 38 and stationary portion 46 may be flopped such that the slip extension 38 may be connected to the bottom track 14 while the stationary portion 46 may be connected to the top track 16.

Regarding their particular construction, each of the slip extension 38 and stationary portions 46 generally comprises a substantially flat and planar web 18 which is defined by a pair of opposing, parallel arranged longitudinal edges 22. Integrally formed with the web 18 is a pair of substantially flat and planar side walls 24 which extend generally perpendicularly outwardly from the web 18 along the longitudinal edges 22. Each of the side walls 24 defines an opposing pair of side edges 68 which are oriented generally perpendicularly relative to the longitudinal edges 22. A pair of inwardly directed flanges 42 may be provided on each one of the side walls 24 of the slip extension 38 and stationary portion 46.

As best seen in Figure 3, at least one of the side edges 68 of the slip extension 38 includes a pair of opposing, parallel and inwardly directed female recesses 52. The female recesses 52 of the slip extension 38 is formed in the side walls 24 along the side edges 68. Each female recess 52 has a generally V-shaped cross-section which is adapted to receive a respective one of the male protrusions 28 formed within the top and/or bottom tracks 16, 14. Likewise, at least one of the terminus ends 26 of the stationary portion 46 includes a pair of opposing and inwardly directed female recesses 52 formed along the side edges 68. Each of the female recesses 52 formed in the stationary portion 46 preferably has a V-shaped cross-section which is also adapted to receive a respective one of the male protrusions 28 of the top and/or bottom tracks 16, 14. As is disclosed in greater detail in commonly-owned U.S.

Patent Application No. 09/979,214, the stud member 34 is adapted to be engaged and interconnect the top and bottom tracks 16, 14 due to the mating of the female recesses 52 with the male protrusions 28.

Referring briefly now to Figures 4 and 12, shown is the side view of the wall structure 10 where can be seen a plurality of stop features 50 formed on the web 18 of the stationary portion 46. The stop features 50 are generally shown as V-shaped configurations and are disposed in spaced relation to one another. The stop features 50 are configured to engage the slip extension 38 of the stud member 34 in order to maintain a desired axial or longitudinal placement relative thereto. The stop features 50 are preferably integrally formed with the web 18 as raised protrusions extending inwardly so as to engage the web 18 of the slip extension 38 and/or a lower terminus end 26 of the slip extension 38. However, it should be noted that the stop features 50 may additionally be formed on the slip extension 38 or on both the slip extension 38 and stationary portion 46. Also shown in Figure 3 is a tab 40 which may be formed on a lower one of the terminus ends 26 of the slip extension 38 in order to aid the manual slideable movement of the slip extension 38 within the stationary portion 46.

Referring briefly now to Figures 4, 8-9 and 12, shown are the male protrusions 28 formed in the side walls 24 of the top and bottom tracks 16, 14. Also shown are the female recesses 52 formed in the terminus ends 26 of the stationary portion 46. As can be seen, each of the male protrusions 28 and female recesses 52 has a V-shaped cross-section and which are sized and configured to nest within one another. A fastener 64 such as a self-tapping sheet metal screw or other suitable fastener 64 may be extended through the male protrusion 28 and into the female recess 52 in order to permanently connect the stud member 34 to the top and bottom tracks 16, 14. Advantageously, countersunk screws are preferably used in order to provide a smooth, flush and unobstructed surface against which the panel member 62 may be mounted to the wall structure 10. In this regard, the V-shaped cross-section of the male protrusions 28 and female recesses 52 facilitates such flush mounting of the screws in order to complete the assembly of the metallic framing portions of the wall structure 10.

Referring now to Figures 1-3, 5-7 and 11, shown is the slip extension 38 which includes a slot 44 formed in at least one of the side walls 24 thereof. Importantly, the slot 44 is configured to allow a fastener 64 (i.e., such as a sheet metal

screw) to extend thereinto in order to allow uninhibited relative sliding motion between the slip extension 38 and the stationary portion 46 of the stud member 34. As can be seen in Figure 5, the slot 44 may be a generally oval shaped cutout formed in a central portion of the side wall 24 of the slip extension 38. However, it is contemplated that the slot 44 may comprise any number of cutouts formed in the side wall 24. For example, the slot 44 may have a generally rectangular or square configuration or a generally rounded configuration.

As can be seen in Figure 5, the fastener 64, which secures an upper portion of the panel member 62 to the non-moveable stationary portion 46 of the stud member 34, is inserted so as to pass through a central location of the slot 44. In this manner, the upper portion of the wall structure 10 comprising the top track 16 and the slip extension 38 may move downwardly relative to the stationary portion 46 such as may occur in extremely cold temperatures. Likewise, the top track 16 and slip extension 38 may move upwardly without effecting the panel member 62. Such upward movement may occur during extreme heating of the metallic structure such as may be caused by a fire adjacent or in the room within which the wall structure 10 is located.

Referring more particularly now to Figure 5, the slip extension 38 may have any length and may have an overall length of about 8" while the slot 44 may have a length of about 2.5". The slot 44 may be located at a distance of about 1.5" from a lower terminus end 26 of the slip extension 38. However, it is contemplated that the slot 44 and overall length of the slip extension 38 may be provided in a wide variety of sizes and relative locations. Regarding mounting of the panel member 62 to the wall structure 10, fasteners 64 may be inserted through the wall member and into the side walls 24 of the lower track along a lower edge of the panel member 62. Fasteners 64 may likewise be extended through the panel member 62 and into the side walls 24 of the stationary portion 46.

As can be seen in Figure 1, 5-7 and 10-11, an uppermost one of the fasteners 64 for securing the wall panel to the wall structure 10 is located to extend through the slot 44. Installation of fasteners 64 into the slip extension 38 above or below the location of the slot 44 would inhibit free movement of the upper portion of the wall structure 10 (i.e., the slip extension 38 and top track 16) relative to the lower portion of the wall structure 10 (i.e., stationary portion 46 and bottom track 14). In this regard, the upper edge of the panel member 62 is only disposed in non-connective and

overlapping relationship to the slip extension 38 and the top track 16. In this manner, the wall structure 10 allows the slip extension 38 and top track 16 to move relative to the panel member 62 such as may occur during heating of the wall structure 10 such as in a fire. The panel member 62 is therefore connectably mounted to the bottom track 14 and a stationary portion 46 but is non-connectively disposed against the slip extension 38 and top track 16. As such, the slot 44 allows for relative sliding motion between the slip extension 38 and the stud member 34 such that the stud member 34 may be lengthened and shortened to accommodate changes in spacing between the top and bottom tracks 16, 14.

Referring now to Figures 6 and 8-9, shown is the wall structure 10 having an elongate top overcap 58 which may be secured in overlapping relationship to the top track 16. Constructed in a manner similar to that described above for the top and bottom tracks 16, 14, the top overcap 58 is comprised of a web 18 having a pair of side walls 24 extending generally perpendicularly outwardly therefrom. Each one of the side walls 24 includes at least one elongate male protrusion 28 formed along the side walls 24 on an edge thereof opposite the longitudinal edges 22 of the web 18. The male protrusions 28 are preferably inwardly directed and are also integrally formed with the side walls 24 of the top overcap 58. The male protrusions 28 are generally V-shaped and extend continuously along respective ones of the longitudinal edges 22.

As best seen in Figures 8 and 9, the male protrusions 28 are formed in the side walls 24 of the top overcap 58 and extend downwardly in overlapping relationship to the top track 16 and/or the panel member 62. Importantly, fire resistant capability is provided to the wall structure 10 due to the overlapping relationship of the top overcap 58 with the panel member 62. More particularly, such fire resistance is enhanced due to the male protrusions 28 of the top overcap 58. More particularly, the male protrusions 28 are configured to slidably bear against an outer surface of the panel member 62 in order to prevent passage of smoke and/or heat along an upper portion of the wall structure 10. Preferably, the web 18, side walls 24 and male protrusions 28 of the top overcap 58 are integrally formed such that the top overcap 58 comprises a unitary structure of generally elongate configuration.

In addition, the side walls 24 of the top overcap 58 are spaced apart so as to allow the male protrusions 28 to bear against outer surfaces of panel members 62

mounted on opposing sides of the wall structure 10. An alternative configuration of the top overcap 58 is shown in Figure 9 wherein the side walls 24 thereof include a pair of the male protrusions 28 formed in the side wall 24. As can be seen in Figure 9, the male protrusions 28 are generally V-shaped cross-sections and are disposed in side-by-side arrangement and extending continuously along a length of the side wall 24 of the top overcap 58. As was earlier mentioned, the top overcap 58 is sized and configured such that at least one of the top overcap 58 male protrusions 28 slidingly bears against an outer surface of the panel member 62.

Referring still to Figures 6 and 8-9, the panel member 62 includes an upper edge which is preferably disposed in spaced relation to the top overcap 58 web 18. A gap 70 is thereby defined between the web 18 of the top overcap 58 and the upper edge of the panel member 62. Advantageously, such gap 70 allows for contraction of the stud member 34 relative to the lower track such as may occur in an extreme reduction in temperature. The gap 70 thereby prevents contact between the panel member 62 and top overcap 58 which could otherwise result in buckling and/or damage to the panel member 62 and thereby compromise the sealing capability of the wall structure 10. Although any gap 70 may be provided, the gap 70 is preferably about  $\frac{3}{4}$ " between the upper edge of the panel member 62 and the top overcap 58 web 18. Fire resistant capabilities of the wall structure 10 may be further enhanced by the installation of a compound 60 within the gap 70. Although any compound 60 may be used, the compound 60 is preferably a fire resistant or fire retardant compound 60 in order to resist heat and allow for appropriate expansion of the metal framing structure.

As can be seen in Figures 8 and 9, the top overcap 58 comprises a substantially flat and planar web 18 which defines a pair of opposing, parallel longitudinal edges 22. Extending perpendicularly outwardly from the web 18 is a pair of substantially flat and planar side walls 24 which are preferably integrally formed with the web 18. The top overcap 58 further includes a pair of opposing parallel and inwardly directed male protrusions 28 integrally formed in respective ones of the side walls 24. Such male protrusions 28 extend continuously along the side walls 24 in spaced relation to respective ones of the longitudinal edges 22. As was earlier mentioned, each male protrusion 28 preferably has a V-shaped cross-section.

The top overcap 58 is preferably configured such that at least one of the side walls 24 at least partially overlaps 66 the top track 16 side wall 24. Furthermore, the

top overcap 58 preferably defines a width between the side walls 24 that is compatible to the width across opposing panel members 62 installed on each side of the wall structure 10. More specifically, the top overcap 58 is preferably configured such that the male protrusions 28 of the side walls 24 and the top overcap 58 slidably bear against the outer surface of the panel member 62 to provide sealing of the wall structure 10.

Referring now to Figures 7 and 10-11, shown is the wall structure 10 which may further comprise a stud overcap 54 and which may be mounted to the stationary portion 46 of the stud member 34. As can be seen in the figures, the stud overcap 54 is preferably disposed in non-connective overlapping relationship to the slip extension 38 and is only connected to the stationary portion 46 such as with mechanical fasteners 64 (i.e., sheet metal screws). The stud overcap 54 comprises a web 18 having a pair of side walls 24 extending perpendicularly outwardly therefrom. In this regard, the stud overcap 54 is generally a channel shaped cross-section. The stud overcap 54 is connected to the stud member 34 at the stationary portion 46 and, more particularly, may utilize at least one mechanical fastener 64 to interconnect a side wall 24 of the stud overcap 54 to a side wall 24 of the stationary portion 46 of the stud member 34.

The stud overcap 54 may further include an aperture 56 shown in Figures 7 and 10-11 as a generally square shaped cutout. Although any shape may be provided for the aperture 56, the aperture 56 is preferably sized and positioned relative to the slot 44 such that a fastener 64 may be passed through the stationary portion 46 side wall 24 and extended into the slot 44. In this manner, the stud overcap 54 may be securely mounted to the stud member 34 without inhibiting relative axial movement of the slip extension 38 within the stationary portion 46. An adjacent panel member 62 may thereby be fastened to the panel member 62 shown in Figure 11 by inserting the fastener 64 through the panel member 62 and into the portion of the side wall 24 adjacent the stud member 34.

The assembly and operation of the fire rated wall structure 10 will now be described with reference to the figures. The top track 16 and bottom track 16, 14 are initially disposed in spaced relationship to one another. In this regard, the top and bottom tracks 16, 14 may be positioned along a flat surface such as a floor in accordance with measurements between a floor and ceiling to which the wall structure

10 is to be assembled. Alternatively, the top track 16 and bottom track 14 may be mounted along respective ones of the floor and ceiling and in general alignment with one another. Mechanical fasteners 64 may be extended through the webs 18 of the top and bottom tracks 16, 14 and into respective ones of the floor and ceiling in order to secure the top and bottom tracks 16, 14 thereto.

In assembling and installing the stud member 34, one of the slip extensions 38 may be slidably inserted within one of the stationary portions 46 such that the female recesses 52 formed on opposing terminus ends 26 of the stud member 34 may be engaged to the male protrusions 28 formed along the top and bottom tracks 16, 14. Preferably, the stud members 34 are oriented in generally transverse or perpendicular placement relative to the top and bottom tracks 16, 14. Due to the slideable nature of the slip extension 38 relative to the stationary portion 46, the stud member 34 may be adjusted to the particular spacing between the top and bottom tracks 16, 14 in order to accommodate variations in floor to ceiling height such as may be caused by construction defects and/or building settling.

More specifically, the telescopic mechanism 36 incorporated into each of the stud members 34 allow for extension and retraction of the slip extension 38 relative to the stationary portion 46 in order to adjust the length of the stud member 34 to suit the floor to ceiling height. Upon installation of the stud member(s) 34 in the top and bottom tracks 16, 14, as is described in detail in commonly-owned U.S. Application No. 09/979,214 entitled "Structural Members and Joining Arrangements Therefore," mechanical fasteners 64 such as self-tapping sheet metal screws may be inserted in an area adjacent the male protrusion 28 in order to secure the side walls 24 of the top and bottom tracks 16, 14 to the side walls 24 of the stud members 34 at the opposing terminus ends 26 thereof.

Preferably, the top overcap 58 is disposed in general abutting relationship with the top track 16 such that the respective webs 18 are in contacting engagement. The panel member 62 may then be mounted on the wall structure 10 such that a lower edge of the panel member 62 is secured to the side wall 24 of the bottom track 14 via a plurality of spaced apart fasteners 64. Likewise, fasteners 64 may be extended through the panel member 62 and into the side wall 24 of the stationary portion 46 in order to non-moveably affix the panel member 62 to the stud member 34 and bottom track 14. Additionally, at least one mechanical fastener 64 may be extended through

the panel member 62 and passing through the side wall 24 of the stationary portion 46 such that the fastener 64 extends into the slot 44 formed in the slip extension 38.

Ideally, the panel member 62 is preferably sized and configured such that an upper edge thereof is disposed in spaced relation to the web 18 of the top overcap 58. As shown in Figures 8-9, the gap 70 defined between the upper edge of the panel member 62 and the web 18 of the top overcap 58 is such that a fire resistant compound 60 may be inserted thereto. Preferably such fire resistant compound 60 additionally includes elastic properties to accommodate relative movement between the upper edge of the panel member 62 and the top overcap 58. Additionally, the top overcap 58 is preferably of a width such that the male protrusions 28 formed along the side walls 24 of the top overcap 58 are disposed in continuous contact with the panel member 62.

Optionally, the stud overcap 54 may be installed on the stud member 34 as shown in Figures 7 and 10 prior to installation of the panel member 62. In such an arrangement, the aperture 56 of the stud overcap 54 is preferably aligned with the slot 44 formed in the slip extension 38 such that fasteners 64 extended through the aperture 56 and into the slot 44 do not impede relative movement between the slip extension 38 and stationary portion 46 of the stud member 34.

As shown in Figure 2, projections 20 may optionally be provided in the web 18 of the bottom track 14. Such projections 20 may be in the form of knurls or bumps formed on an exposed side of the web 18 and are preferably configured to function as gripping features that can engage an upper and/or lower terminus end 26 of the stud member 34. The projections 20 may be punched from the bottom side of the web 18 although other metal forming methods may be utilized in order to produce the protrusions. As is better described in commonly-owned U.S. Application No. 11/146,534, entitled "Structural Member with Gripping Features and Joining Arrangements Therefore," such projections 20 are configured to prevent sliding, slipping and/or general migration of an upper or lower terminus end 26 of the stud member 34. In this regard, it is contemplated that such projections 20 may be additionally formed in the web 18 of the top track 16. It should be noted that the height, size, spacing and number of projections 20 per unit area may be adjusted in order to provide the desired amount of frictional and gripping effect between the bottom and top tracks 14, 16 and the stud members 34.

Additional modifications and improvements of the present invention may also be apparent to those of ordinary skill in the art. Thus, the particular combination of parts described and illustrated herein is intended to represent only certain embodiments of the present invention and is not intended to serve as limitation of alternative devices within the spirit and scope of the invention.

5

## WHAT IS CLAIMED IS:

1. A fire rated wall structure, comprising:

a top track and a bottom track disposed in spaced parallel relation to one another, each one of the top and bottom tracks including:

5 a web having a pair of side walls extending perpendicularly outwardly therefrom and a pair of male protrusions formed along respective ones of the side walls; and

at least one stud member oriented transverse to the top and bottom tracks and comprising a stationary portion and a slip extension slidably nested within the stationary portion, each one of the slip extension and stationary portion including:

10 a web having a pair of side walls extending perpendicularly outwardly therefrom, each one of the side walls having a female recesses formed at one of opposing terminus ends of the side walls, the female recess being adapted to receive a respective one of the male protrusions of the top and bottom tracks;

15 wherein the slip extension includes a slot formed in a side wall thereof, the slot being configured to accommodate a fastener passing through the stationary portion side wall and extending into the slot to allow relative sliding motion between the slip extension and the stud member such that the stud member may be lengthened and shortened to accommodate changes in spacing between the top and bottom tracks.

20 2. The wall structure of Claim 1 further comprising a panel member connectably attached to the bottom track and the stationary portion and being disposed in non-connective overlapping relationship to the slip extension and top track to allow movement thereof relative to the panel member.

25 3. The wall structure of Claim 1 further comprising fasteners extending through the panel member and into the side walls of the bottom track and the stationary portion.

4. The wall structure of Claim 3 wherein at least one of the fasteners extending through the panel member and into the stationary portion side wall also extends through the slot.

30 5. The wall structure of Claim 1 further comprising an elongate top overcap secured to the top track, the top overcap including:

a web having a pair of side walls extending perpendicularly outwardly therefrom, each one of the side walls having a male protrusion formed therealong.

5           6.     The wall structure of Claim 5 wherein the web, side walls and male protrusions of the top overcap are integrally formed such that the top overcap comprises a unitary structure.

          7.     The wall structure of Claim 5 wherein each of the top overcap side walls has a pair of the male protrusions disposed in side-by-side arrangement.

          8.     The wall structure of Claim 5 further comprising:

10           a panel member connectably mounted to the bottom track and the stationary portion and being disposed in non-connective overlapping relationship to the slip extension and top track to allow the slip extension and top track to freely move relative to the panel member;

          wherein the top overcap is sized and configured such that at least one of the top overcap male protrusions slidingly bears against the panel member.

15           9.     The wall structure of Claim 8 wherein the panel member is sized and configured such that an upper edge thereof is disposed in spaced relation to the top overcap web to define a gap therebetween.

          10.    The wall structure of Claim 9 wherein the gap is about three-quarters of an inch.

          11.    The wall structure of Claim 9 further comprising a compound disposed within the gap.

          12.    The wall structure of Claim 11 wherein the compound is fire resistant.

25           13.    The wall structure of Claim 1 further comprising a stud overcap connectably mountable to the stationary portion and disposed in non-connective overlapping relationship to the slip extension, the stud overcap comprising a web having a pair of side walls extending perpendicularly outwardly from the web, at least one of the stud overcap side walls and stationary portion side walls being interconnected.

30           14.    The wall structure of Claim 13 wherein the stud overcap includes an aperture formed in at least one of the side walls thereof, the aperture being sized and positioned complementary to the slot to accommodate a fastener passing through the stationary portion side wall and extending into the slot.

15. The wall structure of Claim 1 wherein the male protrusions and female recesses each have V-shaped cross-sections sized and configured to nest within one another.

16. The wall structure of Claim 1 wherein the web of the stationary portion includes at least one opening sized and configured to accommodate a utility conduit.

17. A fire rated wall structure, comprising:

an elongate top and bottom track, each of the top and bottom tracks being adapted to be positioned along a surface and being disposed in spaced parallel relation to one another, each of the top and bottom tracks having a channel-shaped cross section and opposing terminus ends and further comprising,

a planar web defined by a pair of opposing, parallel longitudinal edges;

a pair of opposing, parallel, inwardly directed male protrusions integrally formed with and extending continuously along respective ones of the longitudinal edges, each male protrusion having a V-shaped cross-section;

a pair of substantially flat planar side walls integrally formed with and extending outwardly from a respective one of the male protrusions in perpendicular relation to the web, the top and bottom tracks being oriented such that side walls of the top track face toward the side walls of the bottom track; and

at least one stud member adapted to be transversely interconnected to the top and bottom tracks in perpendicular relationship thereto, the stud member having a channel-shaped cross-section and an opposing pair of terminus ends and further comprising:

a telescopic mechanism comprising a slip extension at least partially nested within a stationary portion and being adapted to allow the stud member to be lengthened and shortened to accommodate changes in spacing between the top and bottom tracks;

each one of the slip extension and stationary portion having a channel-shaped cross section and opposing terminus ends, one of the terminus ends of each of the slip extension and stationary portion being secured to at least one of the top and bottom tracks, each one of the slip extension and stationary portion comprising:

a substantially flat planar web defined by a pair of opposing, parallel longitudinal edges;

5 a pair of substantially flat planar side walls integrally formed with and extending perpendicularly outwardly from the web along the longitudinal edges, each one of the side walls defining an opposing pair of side edges oriented generally perpendicularly relative to the longitudinal edges;

10 a pair of substantially flat planar flanges extending perpendicularly inwardly from a respective one of the side walls and being coplanar with one another; and

wherein:

15 the slip extension includes a slot formed in at least one of the side walls, the slot being sized and configured to allow a fastener to extend thereinto to allow relative sliding motion between the slip extension and the stationary portion ;

20 the stationary portion including a plurality of stop features formed on the web and disposed in spaced relation to one another, the stop features being configured to engage the slip extension for maintaining a desired axial position thereof relative to the stationary portion, the stop features being integrally formed with the web as raised protrusions extending inwardly therefrom;

25 each one of the slip extension and stationary portion including a pair of opposing, parallel and inwardly directed female recesses formed in the side walls along the side edges at one of the terminus ends, each female recess having a V-shaped cross-section adapted to receive a respective one of the male protrusions of the top and bottom tracks.

30 18. The wall structure of Claim 17 further comprising a panel member connectably mounted to the bottom track and the stationary portion and being disposed in non-connective overlapping relationship to the slip extension and top track to allow the slip extension and top track to move relative to the panel member.

19. The wall structure of Claim 17 further comprising a plurality of fasteners extending through the panel member and into side walls of the bottom track and stationary portion.

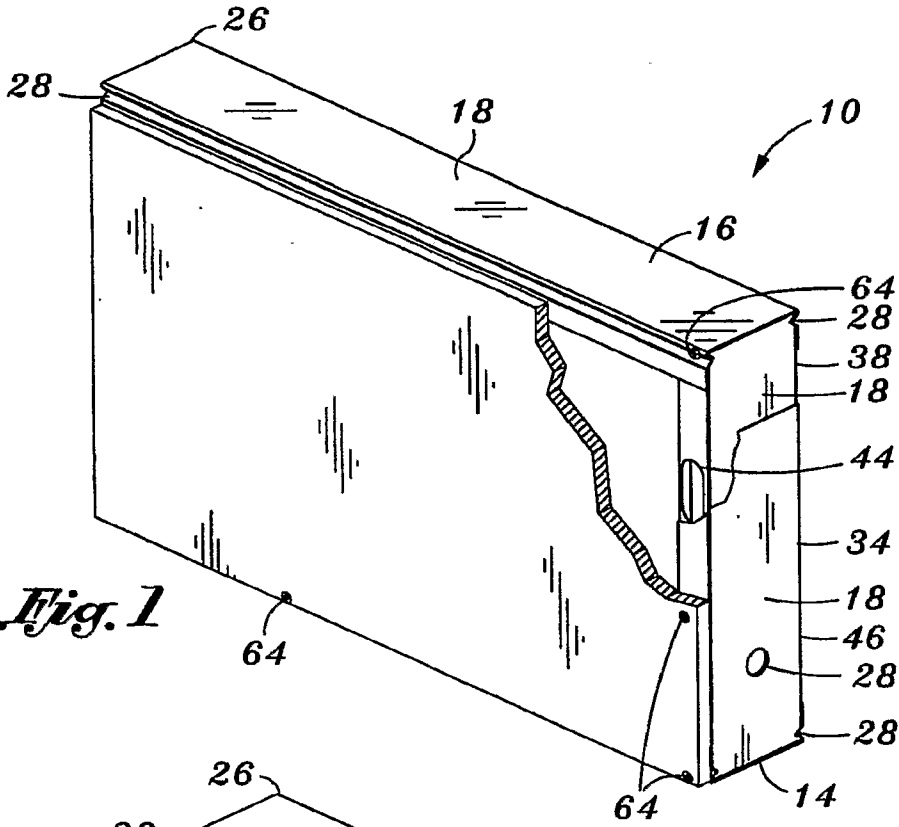
20. The wall structure of Claim 17 further comprising an elongate top overcap having a channel-shaped cross section and being secured in overlapping relationship to the top track web, the stud overcap comprising:

5 a substantially flat planar web defined by a pair of opposing, parallel longitudinal edges, the top overcap web being disposed in abutting contact with the top track web;

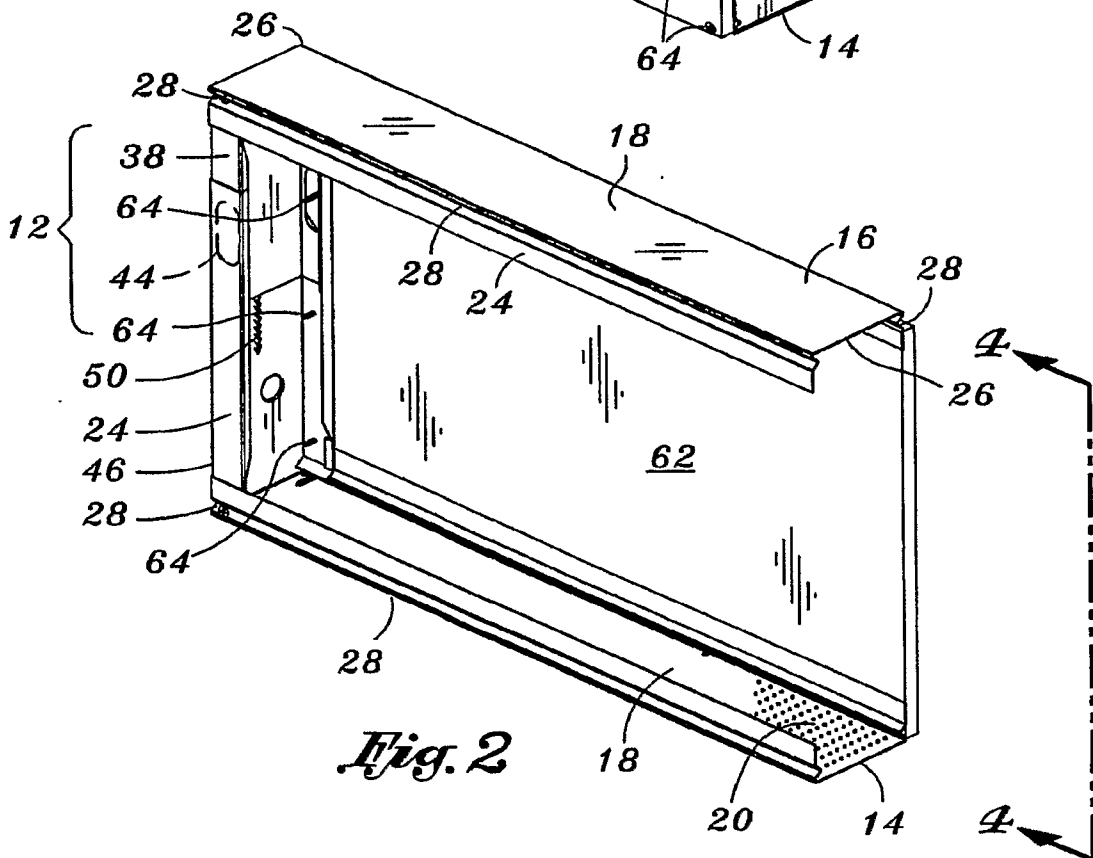
a pair of substantially flat planar side walls integrally formed with and extending perpendicularly outwardly from the web;

10 a pair of opposing, parallel, inwardly directed male protrusions integrally formed in respective ones of the side walls and extending continuously therealong in spaced relation to respective ones of the longitudinal edges, each male protrusion having a V-shaped cross-section, the top overcap being configured such that at least one of the side walls thereof at least partially overlaps the top track side wall.

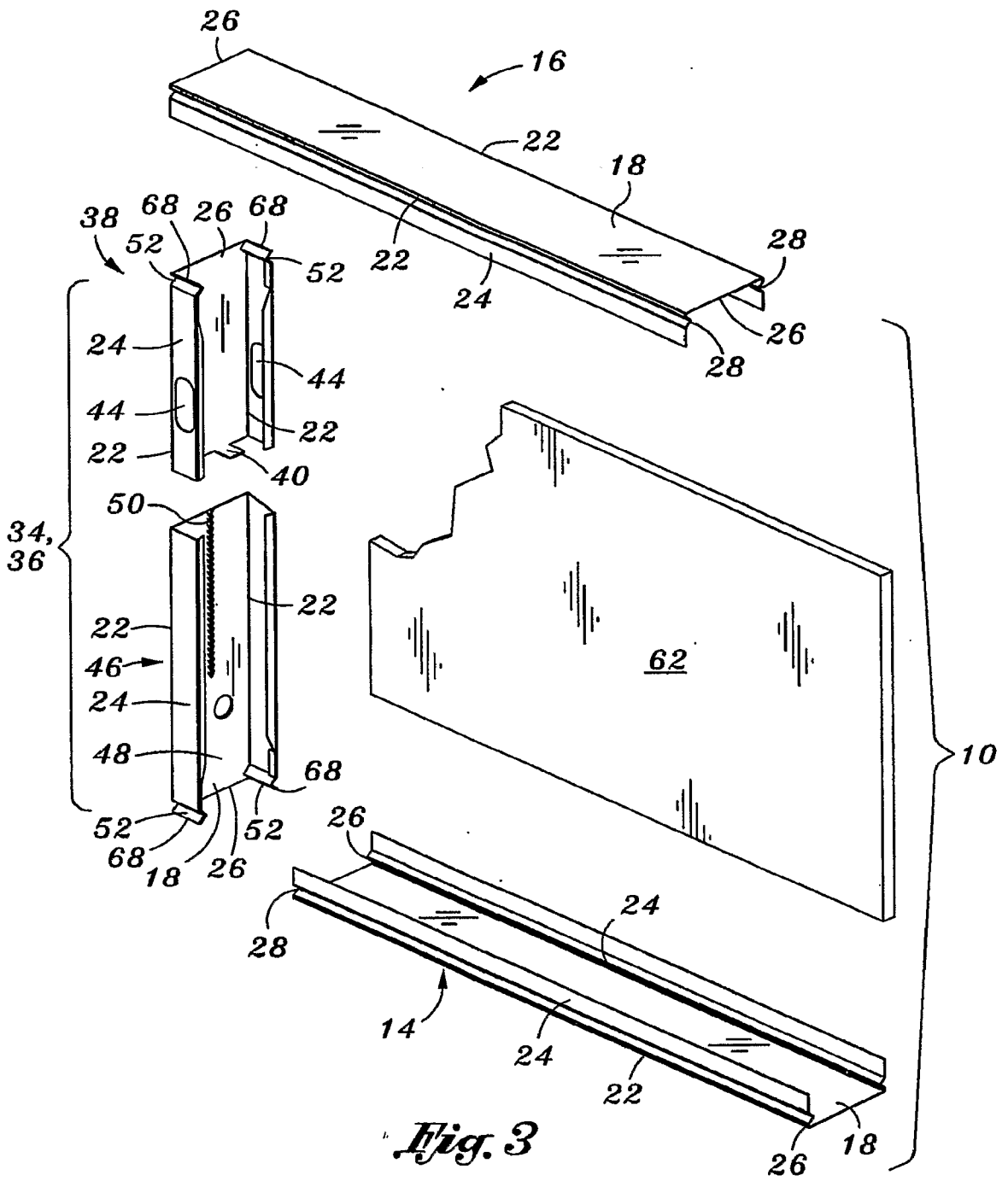
15 21. The wall structure of Claim 20 wherein the web, side walls and male protrusions are integrally formed such that the top overcap comprises a unitary structure.



*Fig. 1*

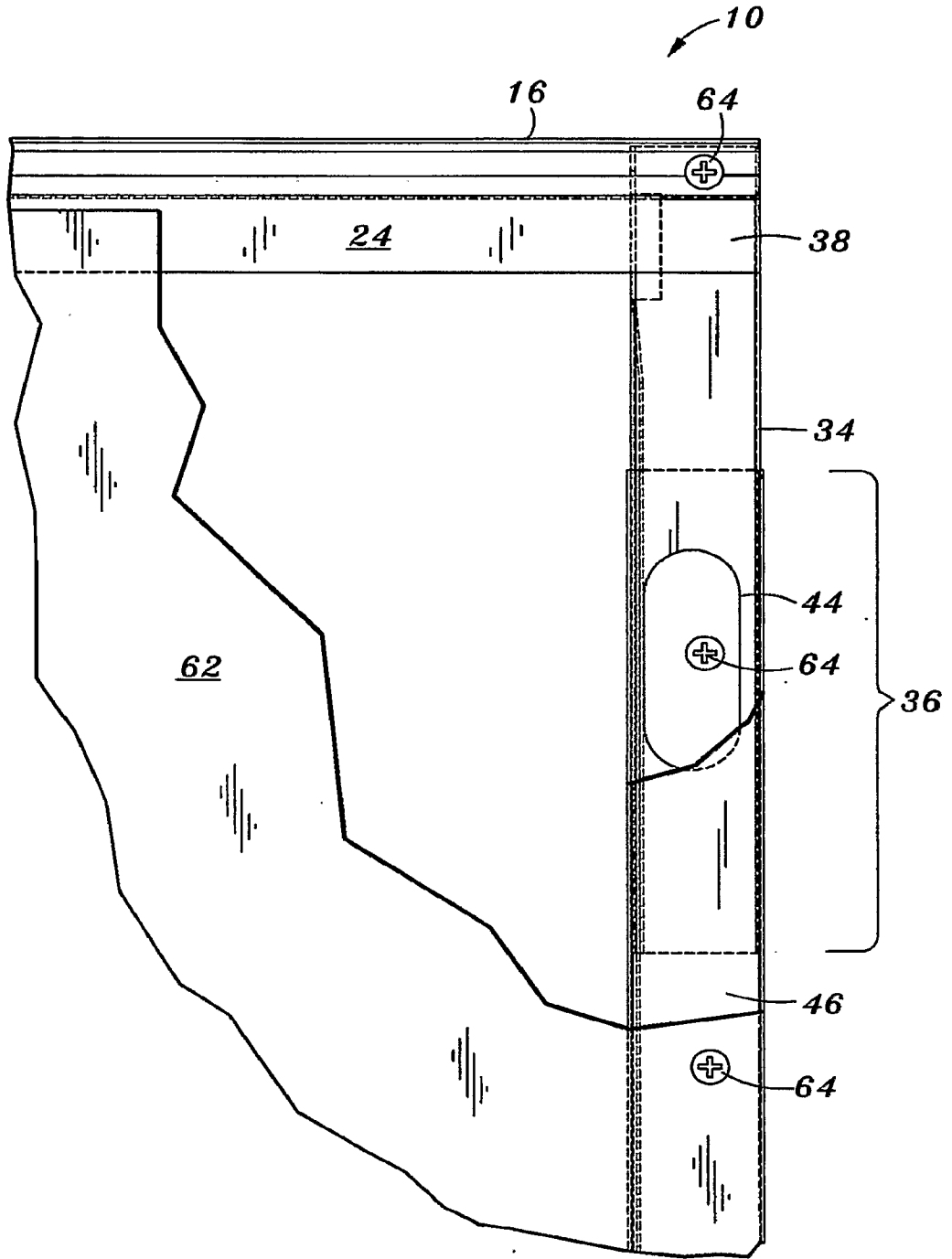


*Fig. 2*



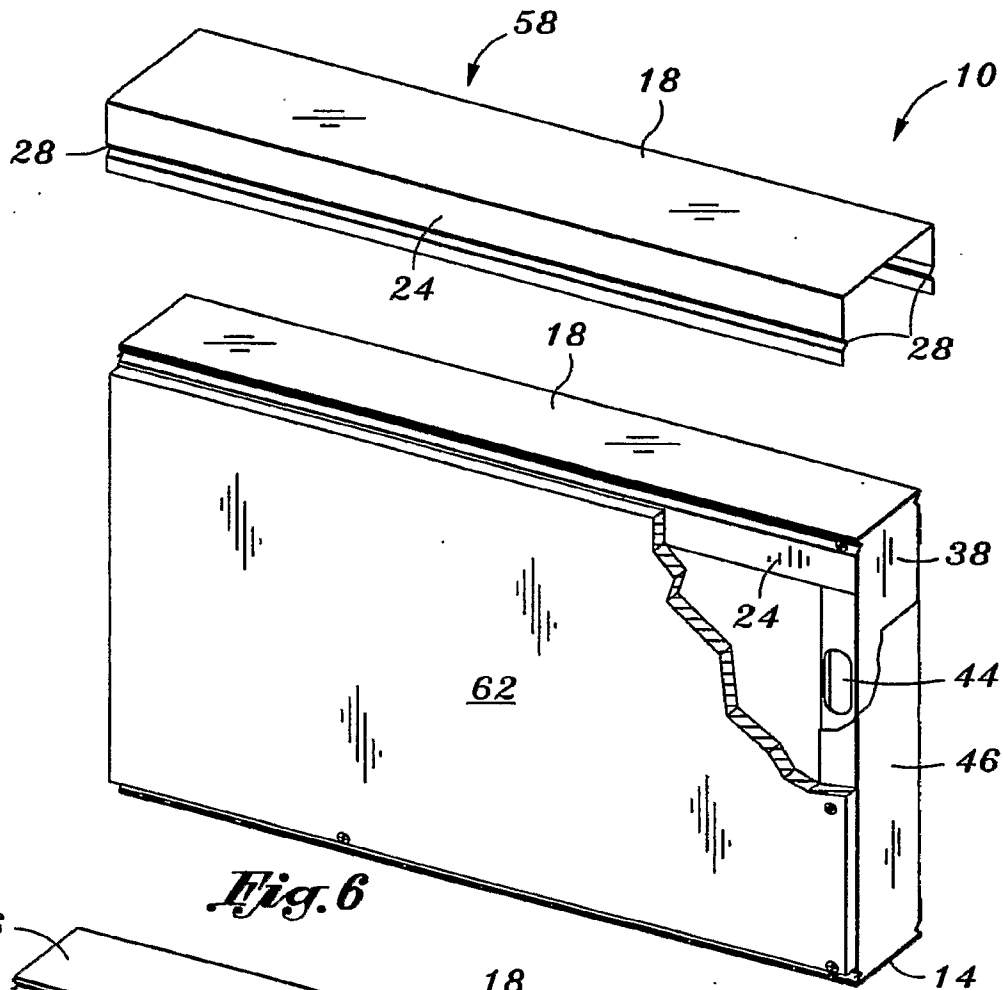
*Fig. 3*



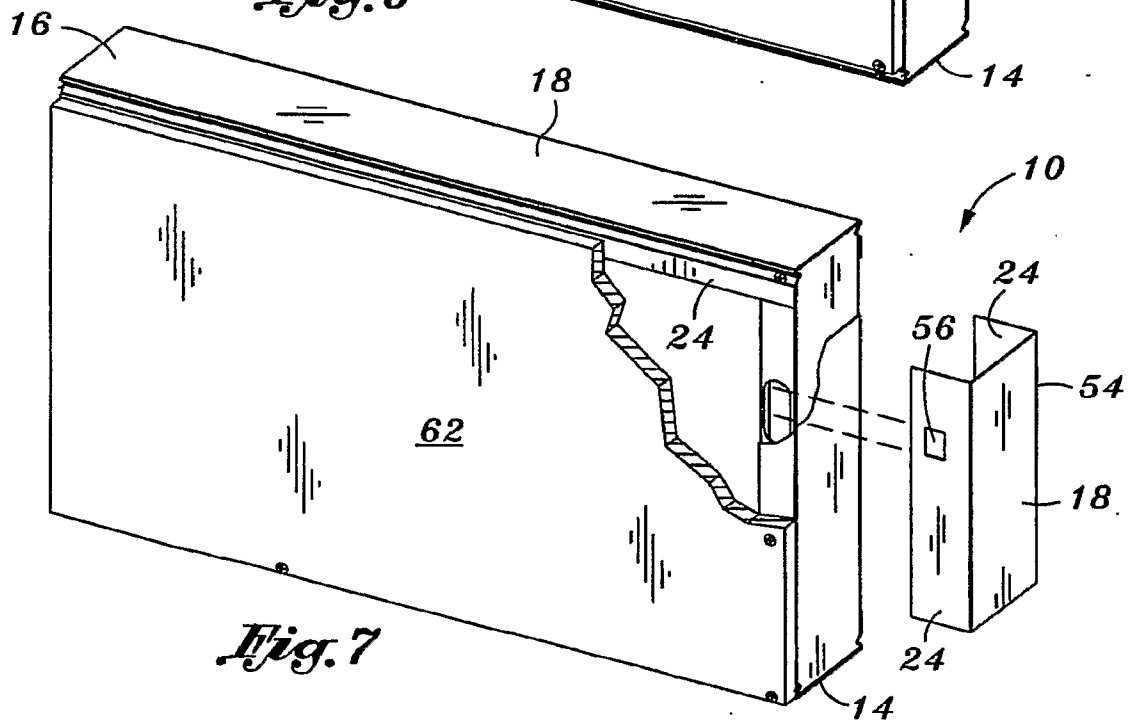


*Fig. 5*

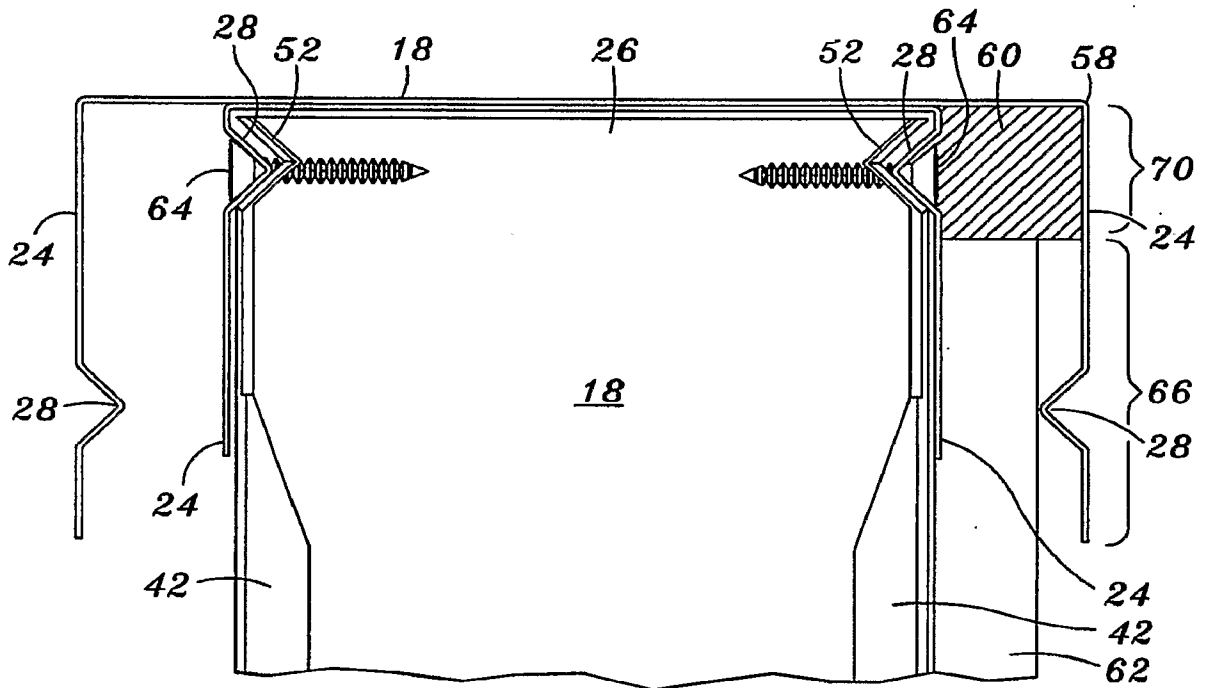
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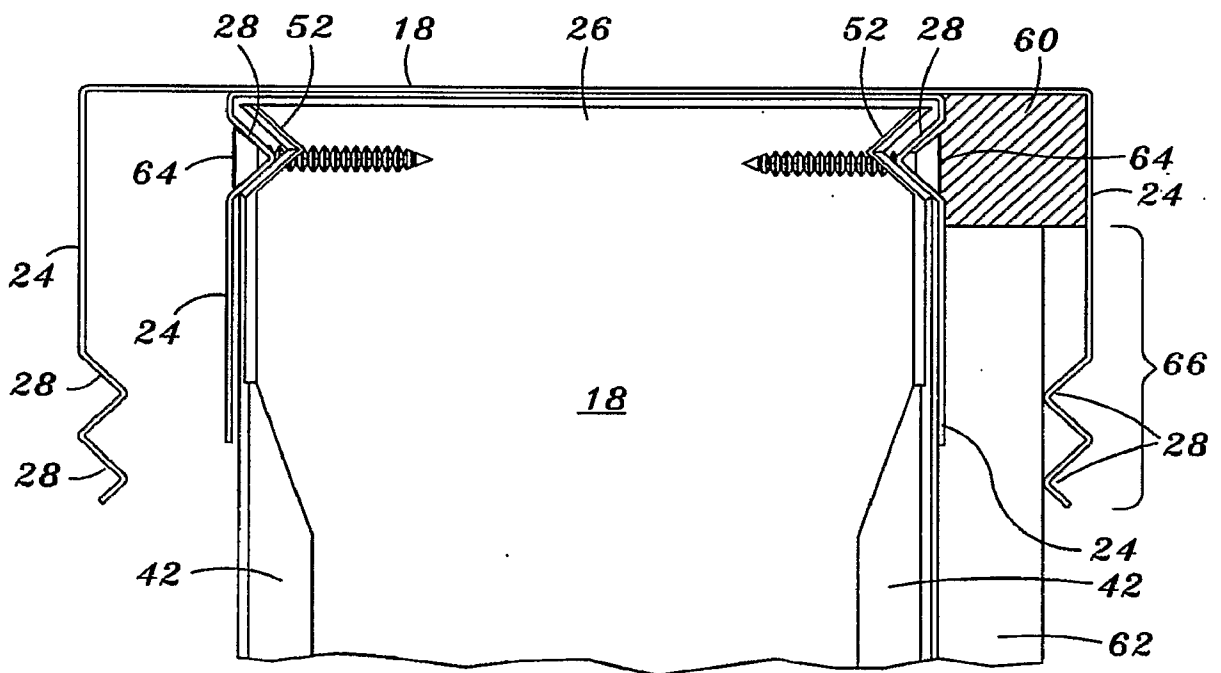
*Fig. 6*



*Fig. 7*

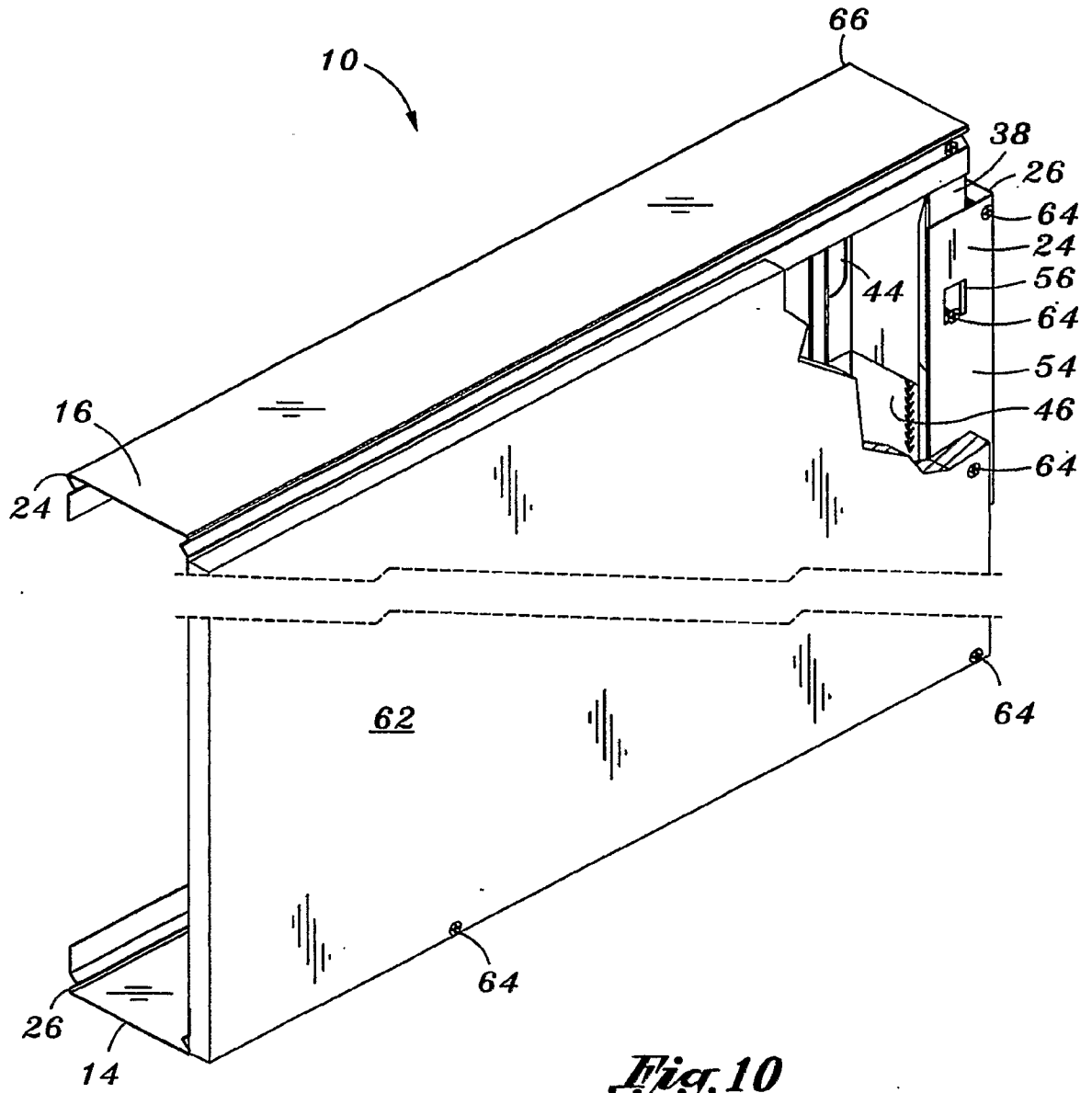


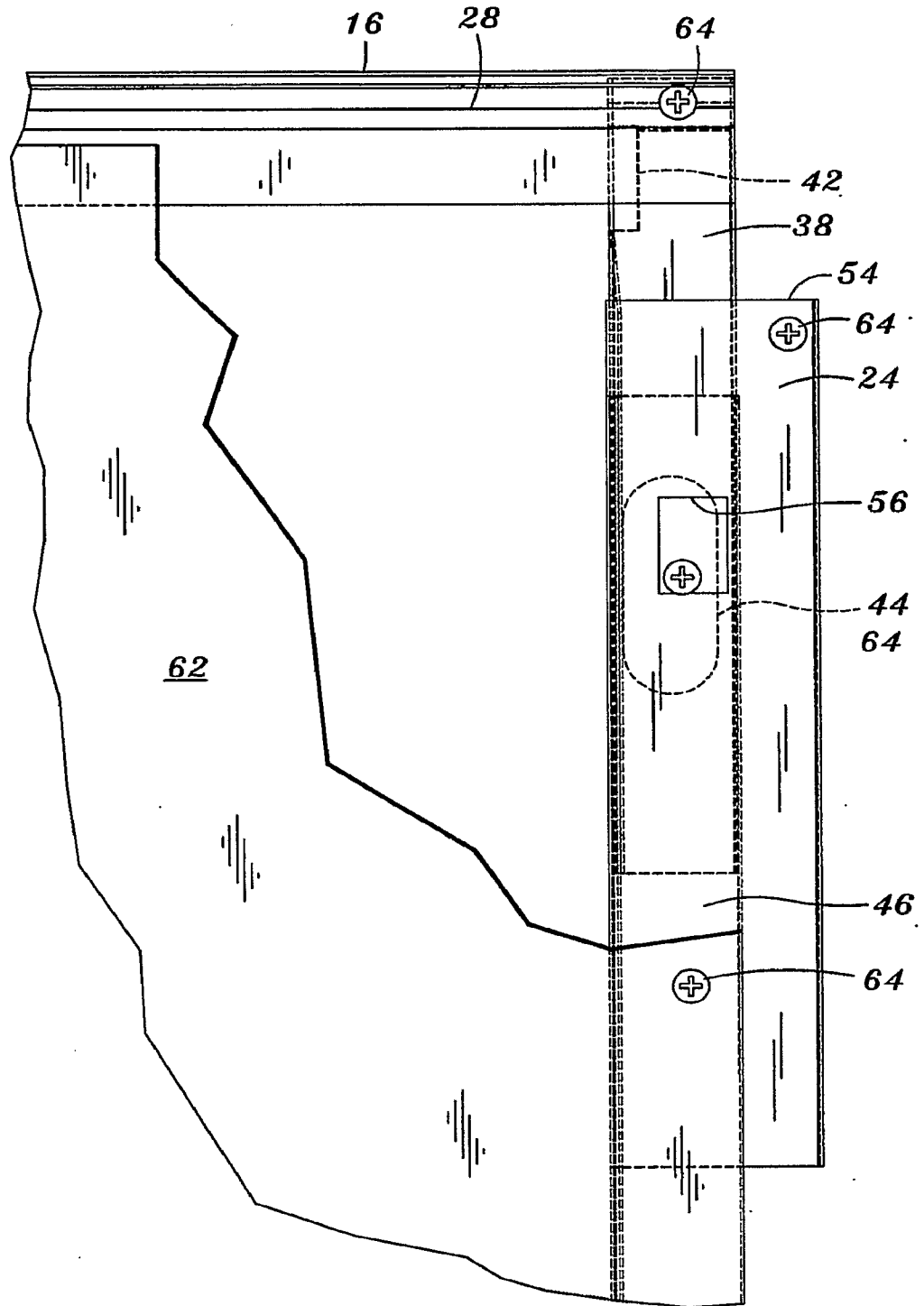
*Fig. 8*



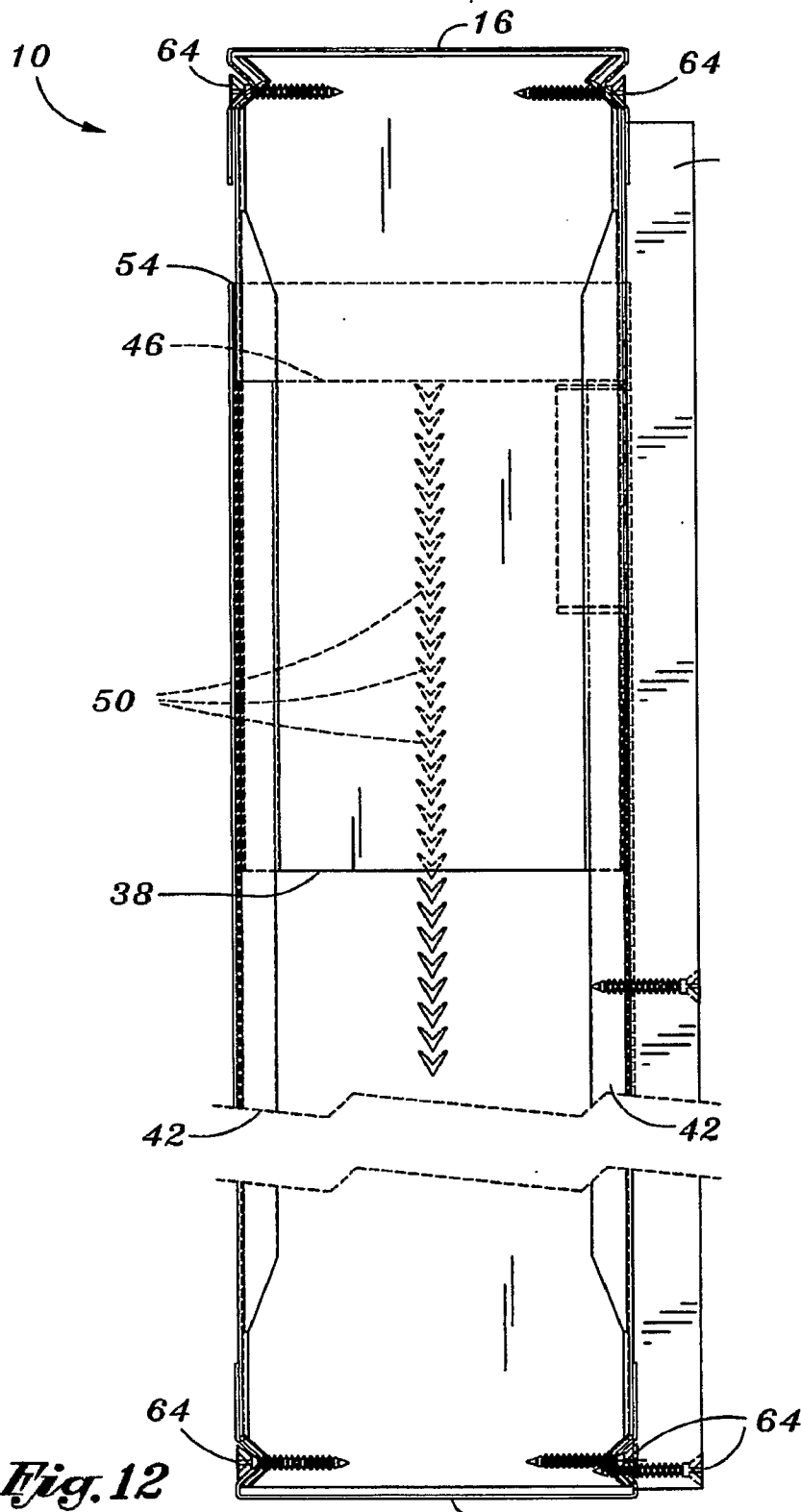
*Fig. 9*

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*Fig. 11*



*Fig. 12*