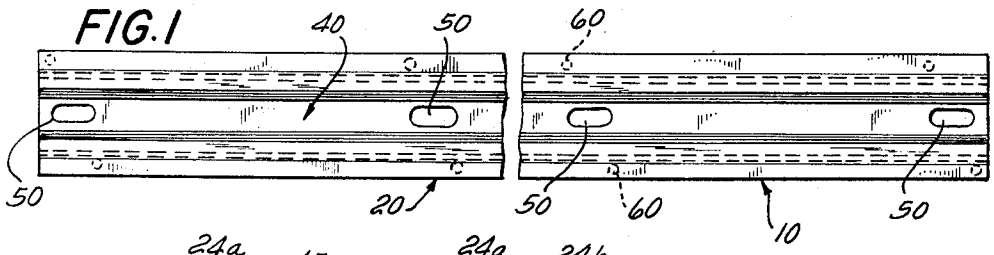
May 28, 1968 R. D. RAMBELLE 3,385,557

MULTI-PURPOSE BUILDING MEMBER

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FIG. 1



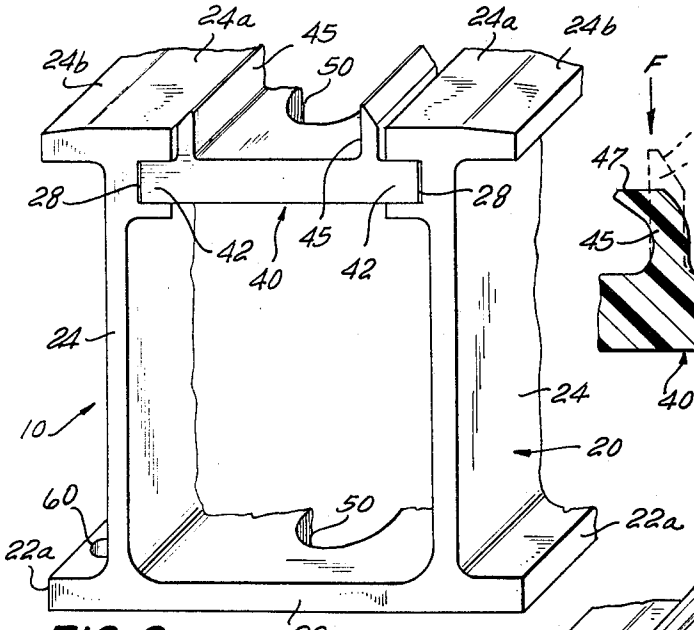


FIG. 2

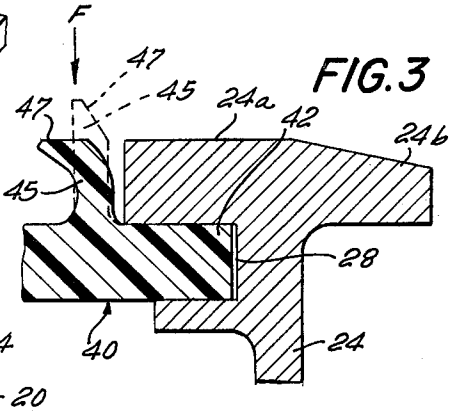


FIG. 3

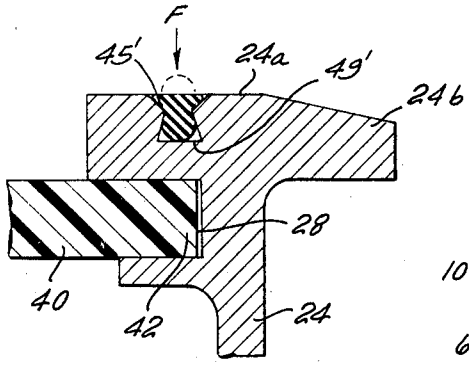


FIG. 5

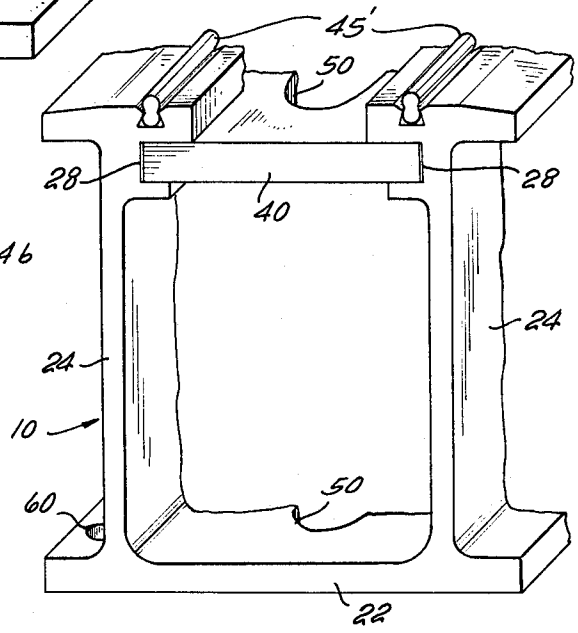


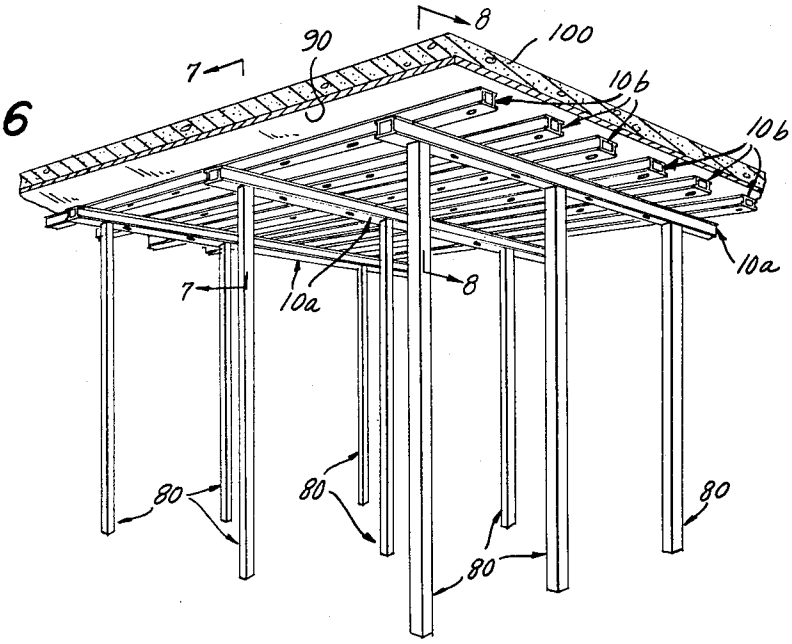
FIG. 4

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FIG. 6



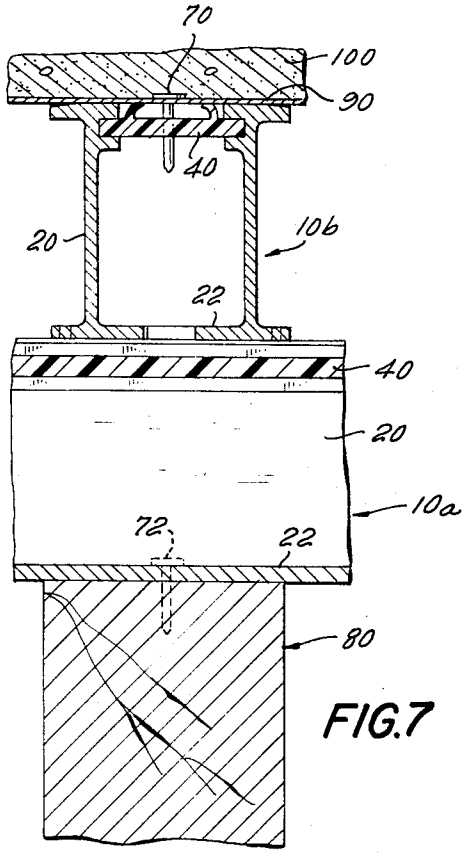


FIG. 7

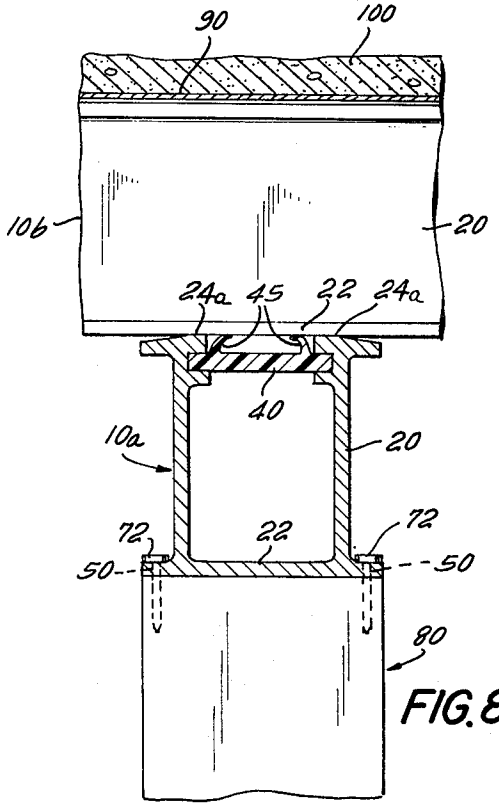


FIG. 8

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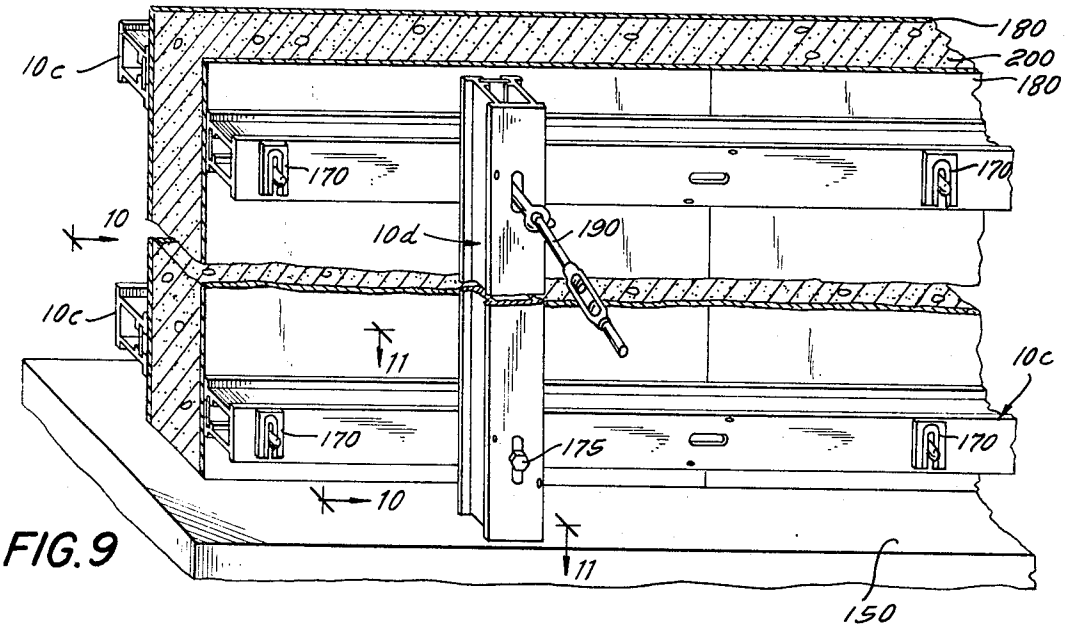


FIG. 9

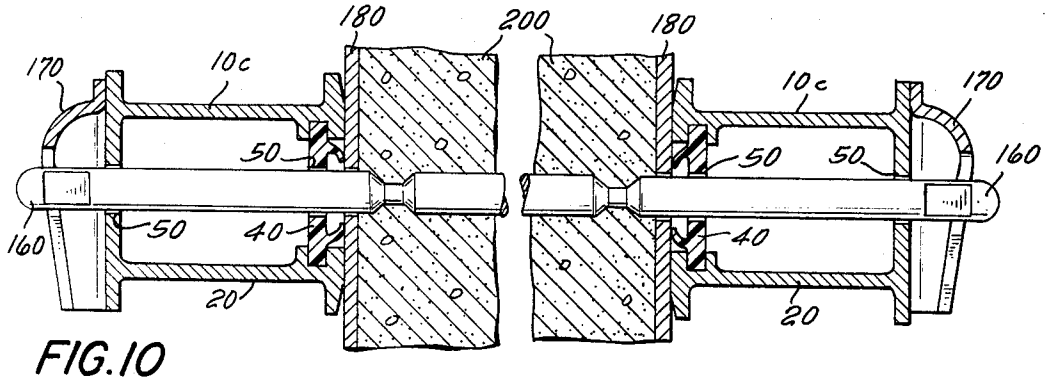


FIG. 10

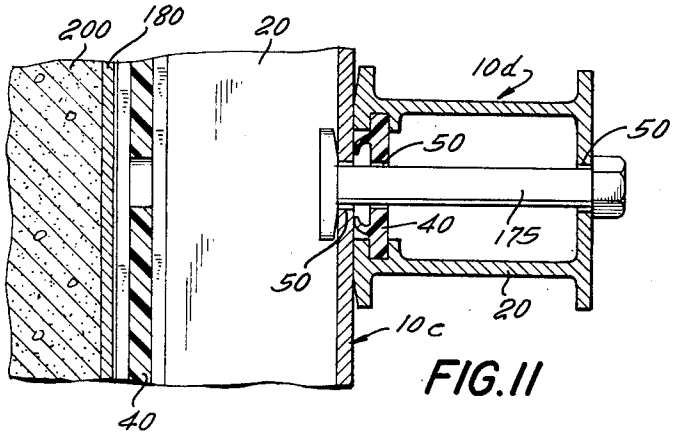


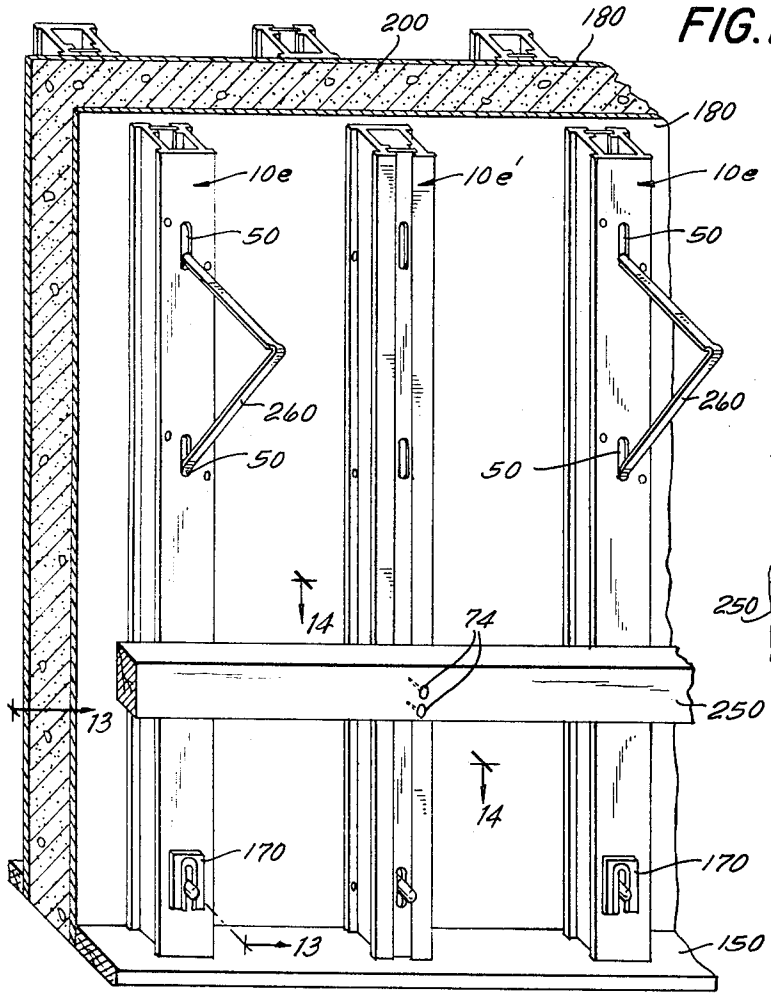
FIG. 11

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FIG. 12



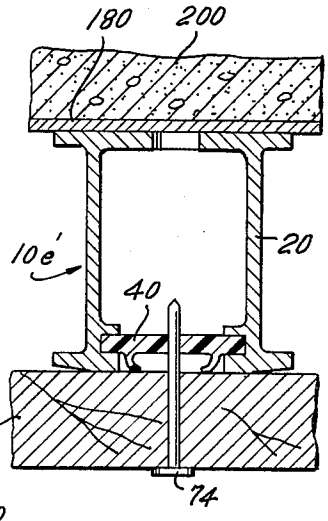


FIG. 14

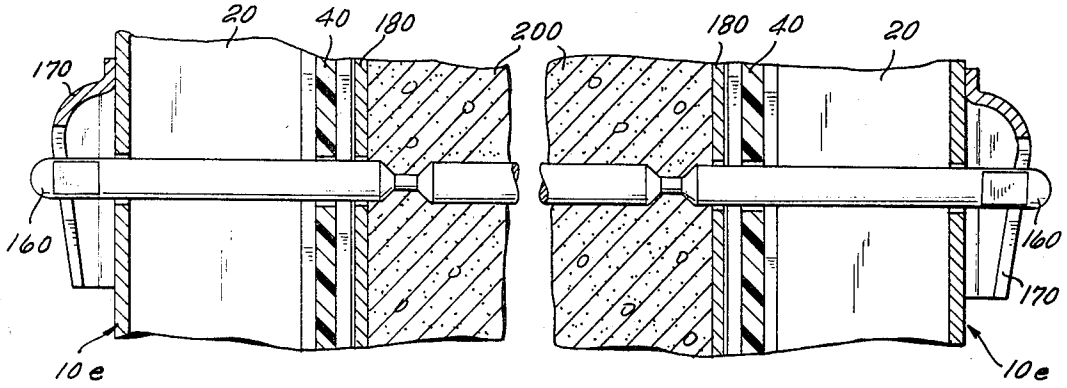


FIG. 13

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3,385,557

MULTI-PURPOSE BUILDING MEMBER

Robert D. Rambelle, 102—26 86th Ave., Richmond Hill, N.Y. 11418

Filed Sept. 15, 1965, Ser. No. 487,555
5 Claims. (Cl. 249—210)

This invention relates to a multi-purpose building member for use in fabricating floors and walls of concrete or other composition material. The building member of the present invention may be utilized in a wide variety of applications as an effective substitute for the wooden beams conventionally employed as framing support members for these purposes. While it may be used with great advantage as a joist and/or stringer element in the temporary suppooring framework for concrete slabs or floors, the present invention finds especial application when used as a waler and/or stud element in supporting and securing concrete wall forms.

Conventional wooden shoring and framing used in the construction of concrete floors and walls are subpect to many serious disadvantages; for example, because of the low carrying capacity and low modulus of elasticity possessed by wooden beams, a great number of them, closely spaced together, are necessary to provide the required support or bracing for the concrete form. In addition, wooden formwork members deteriorate rapidly due to the combined effects of environment and wear, and they therefore have but limited reusability.

On the other hand, the metal shoring and supporting members which have been recently developed and are now in use in concrete construction, while having great bending strength and being capable of a large number of reuses, are not wholly satisfactory either for a number of reasons.

First, there is no provision made in the conventional metal building member for securing the plywood sheathing forms to the shoring beams. Moreover, the metal-to-metal contact, present when both the joist as well as the underlying stringer member are of metal construction, provides low frictional resistance to slippage between the members when a horizintal force is applied. Both of these deficiencies make the use of conventional metal beams unsuitable as well as dangerous for use in the construction of concrete slabs and floors, especially in high-raise structures where wind forces are of great magnitude and thus of considerable concern.

In the case of concrete wall construction, it is conventional for the plywood wall forms to be held in place by a supporting framework comprised of a plurality of wooden horizintal members (walers) or wooden vertical members (studs), or a combination of the two, secured by brackets and tie rods. Again, since the carrying capacity of wood is low, a large number of framing members are required in order to support the wall forms against the tremendous hydrostatic pressures developed in the poured concrete, particularly when the wall to be formed is of substantial elevation. Also, the use of closely-spaced wooden walers and studs requires a great number of steel tie rods and brackets, involving a large inventory of parts and causing expensive installation, stripping and patching operations.

Recently, in an attempt to overcome these disadvantages associated with wooden walers and studding there have been proposals made to employ metal frame members to brace the plywood sheathing used to form concrete walls. However, none of these metal framing members have been found to be entirely satisfactory, primarily because of their limited adaptability to different jobs and their need for specially designed tie rods, fasteners and brackets. As a consequence, up until the present time, metal supporting members have been employed mainly as walers

and stiff-back elements in the gang forming of walls which use prefabricated modular panels having the supporting framework integrally secured thereto.

In contradistinction, the multi-purpose building member of the present invention achieves all the important advantages of a metal beam member (e.g., high load-carrying capacity and high durability permitting a large number of reuses), while retaining all the important attributes of the conventional wooden beams (i.e., nailability, high surface co-efficient of friction, flexibility, and variety of application).

In an exemplary embodiment of the present invention, the building member is in the form of a long hollow beam of generally square, uniform cross-section. The member is comprised of a U-shaped channel section formed from a suitable lightweight metal such as aluminum, and an insert strip placed between the upper leg elements of the U and formed from a nailable, semi-rigid material such as polyvinylchloride or other suitable plastic resin. The plastic insert acts as a lateral bracing support for increasing the structural rigidity of the beam, and also provides a nailable surface for the plywood sheathing forms and other building members used in the fabrication of the concrete floors and walls.

Projecting above the plane surface defined by the upper edges of the U-shaped channel portion of the building member are a pair of flexible, longitudinally-extending protrusions. In a preferred embodiment of the invention these rib-like protrusions are integrally formed out of the plastic insert strip, and in a modified embodiment they are in the form of rubber or neoprene extrusions, separate from the plastic insert strip, and embedded into notches cut into the upper legs of the U-shaped section. In each case these protrusions or rib portions are provided to increase the amount of frictional contact between the respective surfaces of the building member and a vertically-applied loading element so as to minimize the possibility of horizontal slippage there-between. This feature is of particular importance when the building member of the present invention is used in situations where there is metal-to-metal surface contact, as when a metal stringer element supports one or more transversely-arranged metal joist members in the forming framework for the fabrication of a concrete floor. In order to maximize the frictional effect, the building member is designed so that, as the flexible protrusions deform under the weight of the applied load, a greater area of the plastic, rubber, or other composition material is brought to bear against the opposing surface of the loading element. Also, by design, the concentration of the heavier metad portion in the bottom half of the beam's cross-section serves to lower its center of gravity to such an extent that the possibility of tipping of the member in use is minimal.

In order to make the building member of the present invention especially suitable for use as a waler or stud element for wall forming purposes, a plurality of slots, passing in paired alignment through the center of both the insert and the base of the channel section, are spaced at regular intervals along the length of the beam member. These slots permit the necessary tie rods and fasteners to be passed through the beam at spaced locations as required by the loading conditions encountered. They also serve as a means to receive scaffold devices which can be inserted and removed quickly at convenient heights so as to provide working platforms on either side of the wall. The provision of regularly spaced, preformed slots in the building member thus greatly simplifies and expedites the erection of the wall forms and their supports, especially so in the construction of high-rise buildings where the dimensions of the walls are generally invariant for a large number of stories.

By reason of its durable construction and multi-purpose adaptability for a wide range of formwork applications, the novel building member design of the present invention is exceedingly economical in use, since the contractor need not stock and continually replace a large quantity of different kinds of support members, each with its own special function.

It is therefore a principal objective of the present invention to provide a novel design for a building member, for use in providing temporary support in the formation of concrete floors and walls, which is of unitary, light-weight and economical construction, has high load-carrying capabilities, and is readily adaptable for use in a wide variety of formwork applications.

It is a further objective of the present invention to provide a temporary support member of exceptionally safe design, for use as a joist and/or stringer element in the supporting framework for construction of concrete floors and slabs, which possesses good stability against tipping and presents a supporting surface of high frictional resistance to slipping.

It is another objective of the present invention to provide in a temporary support member of hollow, light-weight metal construction, for use as a waler and/or stud element in the supporting formwork for construction of concrete walls, a thin insert of semi-rigid, nailable material for increasing the structural rigidity of the member and for providing a means for securing thereto wall forms and other formwork elements.

It is still another objective of the present invention to provide a multi-purpose temporary support member, for use in the formation of concrete walls and floors, which is comprised of a hollow U-shaped channel section of lightweight metal, a thin insert of semi-rigid, nailable material, and a pair of longitudinally-extending, protruding rib elements formed from a flexible material having a high coefficient of friction.

The foregoing and other objectives, features, and advantages of the present invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

FIG. 1 is a plan elevational view of a preferred embodiment of the multi-purpose building member of the present invention.

FIG. 2 is an end perspective view of the building member shown in FIG. 1.

FIG. 3 is a detail cross-sectional view of the building member of FIG. 1, illustrating the deflection of the insert portion of the member upon the application of a vertical load.

FIG. 4 is an end perspective view of a modified embodiment of the building member shown in FIGS. 1–3.

FIG. 5 is a detailed cross-sectional view of the modified embodiment of FIG. 4, illustrating the deformation of the insert portion of the building member upon the application of a vertical load.

FIG. 6 is a perspective view showing the multi-purpose building members of the present invention used as both joist and stringer elements in providing a temporary supporting framework for the formation of a concrete slab or floor.

FIG. 7 is a detail vertical sectional view taken along the lines **7—7** in FIG. 6.

FIG. 8 is a detail vertical sectional view taken along the lines **8—8** in FIG. 6.

FIG. 9 is a perspective view showing the multi-purpose building members of the present invention used as horizontal waler elements in the formation of a concrete wall.

FIG. 10 is a detail vertical sectional view, taken along the lines **10—10** in FIG. 9, showing the relative positions of the concrete wall, the wall forms, the walers, the tie rods, and the metal brackets supporting walers.

FIG. 11 is a detail horizontal sectional view, taken along the lines **11—11** in FIG. 9, showing the manner in which one of the members, used as a stiff back for alignment purposes, may be secured to the walers.

FIG. 12 is a perspective view showing the multi-purpose building members of the present invention used as vertical studding elements in an alternative method of forming a concrete wall.

FIG. 13 is a detail vertical sectional view, taken along lines **13—13** in FIG. 12, showing the relative positions of the concrete wall, the wall forms, the studs, the tie rods, and the metal brackets supporting the studs.

FIG. 14 is a detail horizontal sectional view, taken along the lines **14—14** in FIG. 12, showing the manner in which a wooden liner may be secured to the studs.

Referring now to FIGS 1–3, there is shown an illustrative embodiment of a multi-purpose building member, constructed in accordance with the teachings of the present invention, for use in providing temporary support in the formation of concrete floors and walls. The member, designated generally by **10**, is comprised of two pieces: an extruded channel section **20** of uniform U-shaped cross-section and formed from a suitable lightweight metal such as aluminum, and an insert strip **40** of a nailable, semi-rigid material such as polyvinylchloride (PVC) or other suitable plastic resin.

The U-shaped channel section **20** comprises a base portion **22** with lateral extending flanges **22*a***, and a pair of vertical sidewall elements **24**, each sidewall terminating in an upper bearing surface **24*a*** with a reinforcing shoulder portion **24*b***. Recessed inside and slightly below the upper edge **24*a*** of each of the sidewalls of the channel section is a notch **28** with a supporting lip for receiving a mating edge **42** of the plastic insert strip **40**.

In the preferred embodiment of the invention shown in FIGS. 1–3, the plastic insert strip **40** is provided with a parallel pair of flexible, rib-like members **45**, protruding above the upper edges of the channel section **20** and extending along the length of the beam member. The end **47** of each of these protrusions **45** is preferably cut on a bias in a manner such that, under the influence of a vertical loading force F, each protrusion in deflection will bend inwardly toward the center of the plastic insert, as shown in FIG. 3. Accordingly, as the protrusions **45** bend inward under the weight of an applied load, a greater area of its surface is brought to bear against the opposing surface of the loading element. By shaping the ends **47** of the protrusions on a slant bias, as shown, the greatest contact area will be obtained when they become flush with the respective upper bearing surfaces **24*a*** of the aluminum channel section **20**. As will be hereinafter more fully explained in connection with FIGS. 6–8, the provision of the protrusions **45** greatly improves the amount of frictional contact present, and minimizes the possibility of horizontal slippage occurring between the building member **10** and an overlying loading element.

The composite box-like cross-section, which is formed of the U-shaped channel section **20** and the semi-rigid PVC insert strip **40**, is structurally sound and provides excellent resistance to all manners of stress caused by forces exerted on the beam during loading conditions. The connection between the PVC insert **40** and the relatively thin sidewall elements **24** of the aluminum channel section **20** is designed such that compressive stresses which are normal to the cross-sectional plane of the member, and produced by longitudinal bending under load, are taken up only by the metal sidewalls **24**. On the other hand, compressive stresses which are perpendicular to the center line of the building member, and caused by the application of lateral forces to the sidewall portions of the channel section, are taken up by the PVC insert which thus performs a bracing function.

The semi-rigid plastic insert **40** is preferably recessed, as shown, so that any vertical load is applied directly to the primary structural components, i.e., the upper bearing surfaces **24*a*** of the metal channel section **20**. The plastic insert can thus be considered as a secondary structural

component or bracing member, providing continuous lateral support to the upper bearing surfaces **24***a* of the aluminum channel section **20**. The above as well as other important structural functions providing by the plastic insert strip are more fully explained in applicant's co-pending application, Ser. No. 411,502, filed Nov. 16, 1964, Now Patent No. 3,336,708 to which reference is made.

The plastic insert **40** also serves as a means for securing plywood forms and other building elements to the beam member **10**. Nails driven through the relatively thin insert strip can freely penetrate beyond the plastic material into the intervening hollow core area without damage to the aluminum section **20** and without deformation of the nails, thereby permitting their ready removal during stripping operations. The recessing of the insert strip **40** slightly below the upper edges **24***a* of the channel section **20** prevents damage to the plastic during erection and stripping operations, and enables repair of damage due to nail perforations to be easily made through the lamination of thin strips or patches of plastic material atop the insert, thereby avoiding the necessity of replacing the entire insert.

Spaced at regular intervals along the length of the building member **10** are a plurality of slots **50**, located in paired alignment at the respective centers of the plastic insert **40** and the base portion of the channel section **20**. As will be more fully explained in connection with FIGS. 9–14, these slots allow the necessary tie rods and fasteners to be passed through the beam **10** when the building member is used as a waler or stud element for wall-forming purposes. The slots **50** are preferably cut in an oblong configuration, as shown in FIG. 1, in order to accommodate slight misalignments in the tie rods, as well as to permit the usage of all the various types of ties (looped ends buttoned ends, etc.) now commercially available.

In order to facilitate the fastening of the beam **10** to vertical shoring supports when the building member is utilized as a stringer element in the formation of concrete slabs and floors, as is shown later in FIGS. 6–8, a plurality of holes **60** may be pre-drilled, if desired through the outer flanges **22***a* of the base portion of the aluminum channel section **20** at spaced intervals along the length of the beam.

FIGS. 4 and 5 illustrate an important modification of the embodiment shown in FIGS. 1–3 wherein the rib-like protrusions **45'** in the building member **10** are in the form of a pair of splines which are separate from the plastic insert strip **40'** and are embedded into dovetailed notches **49'** formed into the respective upper bearing surfaces of the vertical sidewalls **24** of the U-shaped channel section **20**. Under the application of a vertical load F each of the spline inserts, of neoprene, rubber or other suitable elastically-compressible material having high frictional qualities, spreads in width thereby increasing the frictional surface which is brought to bear against the loading element, as is shown in FIG. 5. It is desirable to provide sufficient room in the upper portions of the notch **49'** to allow the spline to deform under load to the point where it is flush with the upper bearing surface **24** of the aluminum channel section. The modified design of the invention shown in FIGS. 4 and 5 permits the rib-like protrusions to be selected from a composition material having better elasticity and frictional qualities than the PVC or other semi-rigid, nailable material used in the composition of the insert **40**.

In use, in the formation of a concrete slab or floor as illustrated in FIGS. 6–8, the multi-purpose building member of the present invention may be used as both joist and stringer elements in the temporary supporting framework. The lateral support beams or stringer elements **10***a* are first mounted on top of their supporting posts or shores **80** by nails **70** driven through the holes **50** provided in the base flanges **22** of the building member, as in the manner shown in FIG. 8. The horizontal shoring members or joists **10***b* are then laid down in transverse rows on top of the stringers **10***a*. Finally, the plywood sheathing forms **90** for the formation of the concrete slabs or floors **100** are placed on top of the rows of joists **10***b* and secured thereto by nails **72** driven through the plastic insert strip **40**, as shown in FIG. 7.

As illustrated in FIG. 8, the weight of the loaded joist member **10***b* presses down the flexible protrusions **45** on the plastic insert **40** until they are flush with the upper bearing surfaces **24***a* of the underlying stringer beam **10***a*. As explained earlier, the slant angle design on the end of the protrusions **45** provides the greatest amount of frictional gripping surface for engagement with the underside of the metal base portion **22** of the transversely-arranged joist member **10***b*, thereby minimizing the possibility of slippage between the metal members. Even though no nails or other fasteners are used to connect the joist member **10***b* to the supporting stringer **10***a*, it is exceptionally stable against the hazards of overturning as well as sliding because most of the weight of the beam is concentrated in the lower half of its cross-section. As a result of both of these innovations in safety design, the building members of the present invention are ideally suited for use as unsecured joist elements in the temporary supporting framework for concrete floor formation.

FIGS. 9–11 illustrate the multi-purpose building member of the present invention in use as both walers **10***c* and stiffback elements **10***d* in the formation of a concrete wall. Shown arranged in conventional manner atop a floor or foundation base **150** is the usual supporting formwork for the poured concrete wall **200** comprising, wall forms **180** of plywood sheathing, horizontal supporting walers **10***c*, steel tie rods **160** passing through the slots **50** in the walers, and metal brackets or clamps **170** securing the ends of the tie rods. Vertical stiffback elements **10***d*, fastened to the horizontal waler elements **10***c* by bolts **175** through the slots **50** (see FIG. 11), are provided at spaced locations for bracing the entire assembly with guy wires or supporting cables **190**. The location of the slots **50** at the centroid of the building member of the present invention avoids eccentric loading conditions on the walers **10***c*, and thus prevents the creation of torsional forces on the wall formwork. Also, the spacing of these slots **50** at regular intervals along the length of the beam members facilitates the erection and spacing of the waler and stiffback elements **10***c* and **10***d* in the wall framework. If desired, the assembly of the framework can be speeded-up by the pre-drilling of holes in the plywood wall forms **180** at points corresponding to the required locations of the tie rods **160**.

FIGS. 12–14 illustrate another manner of using the multi-purpose building members of the present invention as vertical studding elements or stiffbacks **10***e* in the formation of a concrete wall. In this latter arrangement, the plywood walls forms **180** which retain the poured concrete **200** are primarily supported by vertical members or stiffback elements **10***e*, rather than by horizontal waler elements as shown previously in FIGS. 9–11. To exemplify the various uses to which the pre-formed slots **50** in the building members may be put a pair of scaffold bracing members **250** are shown attached to the studs **10***e*. A wooden liner **250** may be fastened to the formwork for alignment purposes by arranging a few of the stud elements **10***e'* with their plastic side facing outward from the wall, and then securing the liner thereto by nails **74**, as shown in FIG. 14.

The terms and expressions which have been employed here are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions of excluding equivalents of the features shown and described, or portions thereof, it being recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. A building member, for use as stringers and joists in providing temporary support in the formation of concrete floors, comprising,

(a) a longitudinally-extending metal section of generally U-shaped cross-section having a base portion and a pair of vertically-extending sidewall elements,

(b) a thin, longitudinally-extending insert strip of nailable, semi-rigid material positioned horizontally between said sidewalls, and recessed slightly beneath the upper edges thereof, to form with said channel section a composite box-like beam member, and

(c) a longitudinally-extending rib element, formed from a flexible material having good frictional properties, said rib element normally projecting above the horizontal plane formed by the upper sidewall edges of said U-shaped channel section but deforming under an applied vertical load so as to become flush with said plane, whereby said beam member is provided with a slide-resistant frictional bearing surface.

2. A building member according to claim **1**, wherein said insert strip is of plastic resin material, and said projecting rib element is in the form of a spaced, parallel pair of protrusions integrally formed out of the upper surface of said strip.

3. A building member according to claim **2**, further characterized in that the end of each of said protrusions is cut on a bias such that each protrusion will, in deformation under loading, invariably deflect toward the center of said insert strip and bring a greater area of its surface into frictional contact with said load.

4. A building member according to claim **1**, wherein said insert strip is of plastic resin material, and said projecting rib element is in the form of a pair of splines of elastically-compressible material, each separate from said strip and each secured to said beam member by a longitudinal keyway groove formed in the upper adge of a respective metal sidewall of said U-shaped channel section.

5. A multi-purpose building member, for use in providing temporary support in the formation of concrete floors and walls, comprising,

(a) a longitudinally-extending metal channel section of generally U-shaped cross-section having a base portion and a pair of vertically-extending sidewall elements,

(b) a thin, longitudinally-extending insert strip of nailable, semi-rigid plastic resin material positioned horizontally between said sidewalls, and recessed slightly beneath the upper edges thereof, to form with said channel section a composite box-like beam member, and

(c) a plurality of slots spaced in paired alignment in said insert strip and in the base portion of said channel section and positioned at predetermined regular intervals along the length of said beam member.

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WILLIAM J. STEPHENSON, *Primary Examiner.*