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[54] **APPARATUS AND METHOD FOR EMPLOYING GYPSUM BOARD AS FORMS FOR POURED CONCRETE CEILING AND FLOOR STRUCTURES**

[75] Inventors: **Burr E. Tupper**, Oakland, Calif.; **Luis Cejudo Alva**, Edo De, Mexico

[73] Assignee: **Kaiser Gypsum Company, Inc.**, Oakland, Calif.

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[52] **U.S. Cl.** **52/741**, 52/127, 52/329, 52/334

[51] **Int. Cl.** **E04g 21/00**

[58] **Field of Search** 52/320, 325, 338, 339, 52/329, 381, 577, 741, 334, 127

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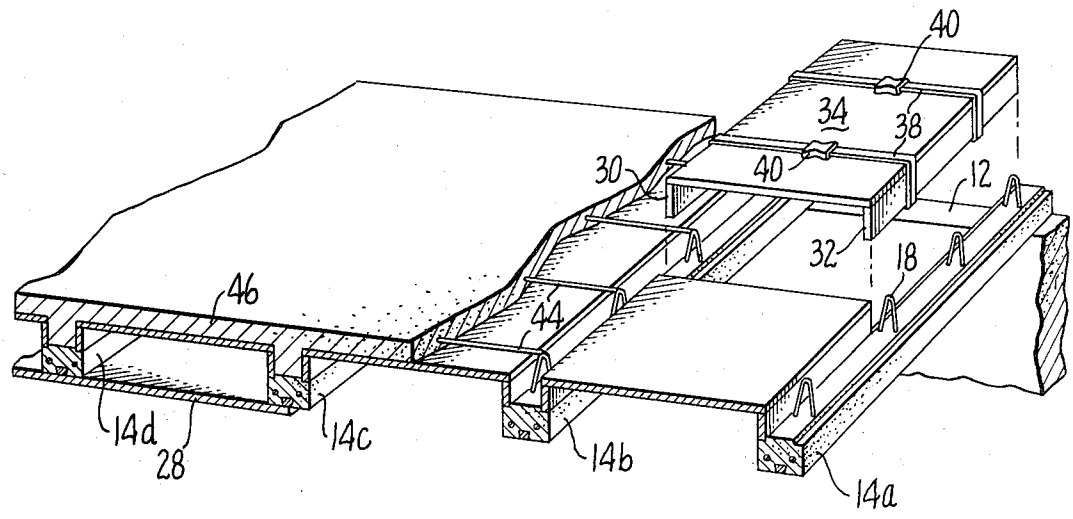
Primary Examiner—Alfred C. Perham

Attorney, Agent, or Firm—James E. Toomey; John K. Uilkema

[57] **ABSTRACT**

A form element for use in constructing concrete ceiling and floor structures. The form element includes two gypsum board strips and a gypsum board sheet assembled in a U-shaped configuration. The gypsum board pieces are retained in such configuration by two or more spacers within the U shape; steel strapping circumscribing the structure at the locations of the spacers retain the parts in assembled condition. The form element is inverted and placed on two adjacent joists with the gypsum board sheet spanning the space between the joists. The spacers support the sheet so that it can support fluid concrete placed thereon. After the concrete cures, the spacers are removed by cutting the strapping. A method for forming the ceiling and floor structure is also disclosed.

2 Claims, 3 Drawing Figures



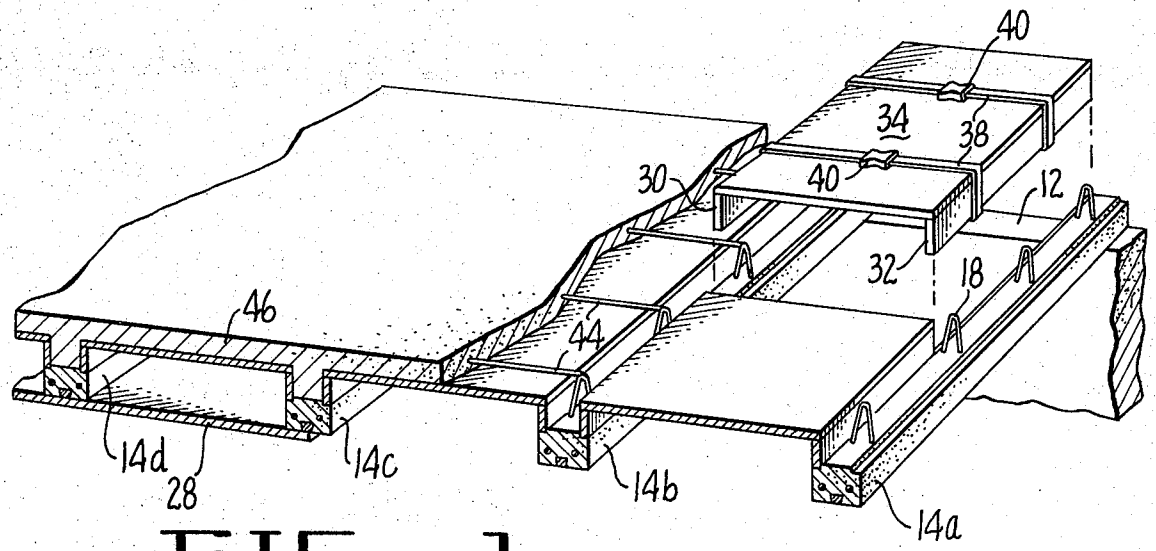


FIG. 1.

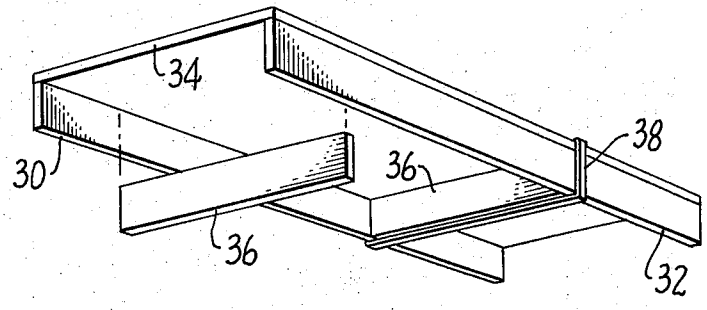


FIG. 3.

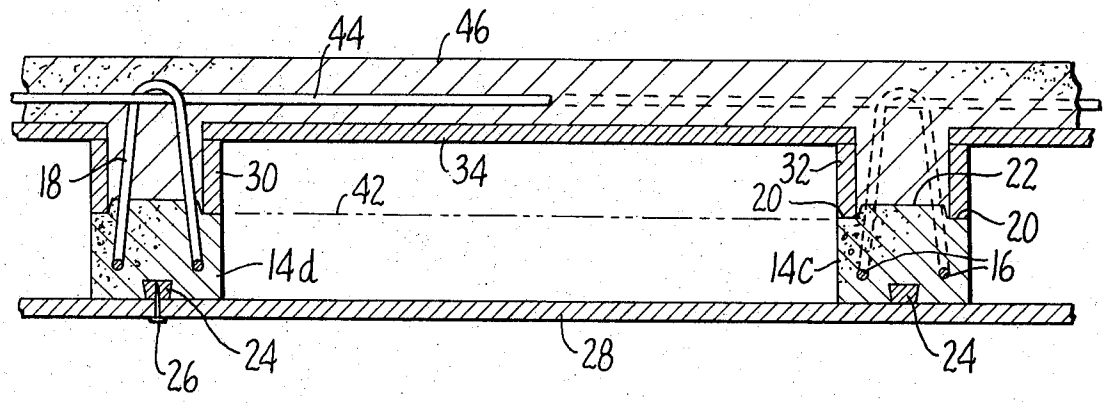


FIG. 2.

APPARATUS AND METHOD FOR EMPLOYING GYPSUM BOARD AS FORMS FOR POURED CONCRETE CEILING AND FLOOR STRUCTURES

This invention relates to a method and apparatus for forming concrete ceiling and floor structures and more particularly for employing gypsum wall board pieces as part of the form in constructing such ceiling and floor structures.

Known prior art techniques for constructing form work for poured concrete floor and ceiling structures involve either the installation of metal or wooden form structures which are removed after pouring and curing of the concrete or the provision of precast concrete units which remain in place after the concrete is poured and cured. Although these prior art techniques have resulted in floor and ceiling structures of excellent strength and fire resistant characteristics, they involve either the provision of specially designed fabricated units or the complex time consuming operations of constructing wooden form work and removing the same after the concrete is poured which removal is essential in achieving a fire resistant structure.

The present invention by way of contrast provides a novel form element that can be quickly fabricated and that is made substantially entirely of gypsum wall board. The gypsum wall board is left in place and does not detract from the fire resistant character of the floor and ceiling structure. Rather, it enhances the sound and thermal insulative properties of the structure. In the preferred embodiment the form element is composed of two narrow gypsum board strips and a gypsum board sheet that spans the upper edges of the strips in a generally inverted U-shaped configuration. The three gypsum board pieces are retained in assembled relationship by installing two or more spacers, preferably constructed of lumber, that span the two strips. The spacers are retained in place in the preferred embodiment by a steel band or strap that circumscribes the entire structure. Thus, the spacer in addition to maintaining the form element in its proper configuration, supports the center of the gypsum board sheet while it in turn supports concrete placed thereon until the concrete cures. After the concrete cures, the spacers can be easily removed such as by cutting the steel strap that retains them so that the resultant floor and ceiling structure is entirely non-combustible.

The cost advantage of gypsum board over lumber is notorious. Gypsum board, because it is a manufactured product, can be provided with close tolerances in any thickness or length or width. Accordingly, the present invention makes feasible the construction of a large plurality of the form elements referred to above either at the job site or at a location remote from the job site, and the elements not only provide a concrete impervious form member but serve to space horizontal joists or beams which form a part of the completed floor and ceiling structure.

As is the case in the prior art, floor and ceiling structures according to the present invention are formed by first installing a plurality of pre-formed beams or joists, the ends of which typically rest on a previously constructed bearing wall. The beams or joists, which are preferably formed of steel reinforced concrete, have along their top edges, a marginal shoulder that has a width approximating the thickness of the gypsum board strips. When the beams are in place the form elements described above are placed so that the lower surfaces

of the gypsum board strips reside in the marginal shoulders. Thus, the form elements assist in properly aligning the beams and the beams when properly installed reinforce and support the form elements of the invention.

The objects, features and advantages of the present invention will be more apparent after referring to the following specification and accompanying drawing in which:

FIG. **1** is a perspective view partially broken away and partially exploded which shows a floor and ceiling structure and a form therefor constructed according to the present invention;

FIG. **2** is a cross-sectional elevation view of a completed floor and ceiling structure formed according to the invention; and

FIG. **3** is a perspective view of a form element according to the invention.

Referring more particularly to the drawing reference numeral **12** indicates a bearing wall formed in any suitable manner and constituting no part of the present invention. A second bearing wall (not shown) is typically provided in parallel spaced relation to wall **12.** Spanning the walls are a plurality of substantially identical beams or joists **14***a*, **14***b*, **14***c*, **14***d*. As seen most clearly in FIG. **2,** each joist is formed of reinforced concrete material having longitudinally extending reinforcing bars **16** from which extend upwardly at appropriate intervals U-shaped saddle members **18** also made of reinforcing steel. At the marginal edges of the upper surface of each joist is a shoulder **20** which exists by virtue of an upstanding medial portion **22.** Saddle members **18** are confined within medial portion **22** to avoid interference with marginal shoulders **20.** The width of marginal shoulders **20** is significant and in one structure designed according to the present invention is approximately ½ inch. On the lower surface of joist **14** is a dove-tail shape wooden nailing strip **24** which is adapted to receive nails **26** for mounting gypsum ceiling boards **28** in the completed structure.

Supported on opposite shoulders of adjacent joists **14** are the lower edges of gypsum board strips **30** and **32.** Strips **30** and **32** are rectangular and identical to one another in shape and size. The vertical dimension of gypsum board strips **30** and **32** is chosen in accordance with the desired dimensions of the completed floor and ceiling structure and the expected load on it, a dimension of 7 centimeters or about 2¾ inches having been found satisfactory in one structure designed according to the present invention. Spanning the upper edges of gypsum board strips **30** and **32** is a gypsum board sheet **34.** The length of the gypsum board sheet, i.e., the dimension in a direction parallel to the longitudinal axis of joists **14** is chosen such that the final form element can be conveniently handled and installed by workmen and also in accordance with the overall span of the floor and ceiling structure involved.

For retaining the form element in assembled condition during its installation on joists **14,** a plurality of spacers **36** are provided. The length of spacers **36** is equivalent to the distance between lateral faces of adjacent joists **14.** Stated otherwise, the length of spacers **36** is equal to the width of gypsum board sheet **34** less the combined thicknesses of gypsum board strips **30** and **32.** The parts of the form element of FIG. **3** are retained in operative relationship by a steel strap **38** or like tension member that circumscribes the spacer **36,** gypsum board strips **30** and **32,** and gypsum board

sheet **34.** Although the steel strap **36** can be nailed in place, it is preferred to secure it by a conventional strap connector **40** (see FIG. **1**). Wire of adequate strength can also be employed for the tension member. Accordingly, when the form element is in place, the lower edge of spacer **36** will be roughly co-extensive with phantom line **42** in FIG. **2**, the phantom showing in FIG. **2** indicating that the spacer is removed when the floor and ceiling structure has been completed. The upper edge surface of spacer **36** supports gypsum board sheet **34** so that wet concrete placed thereupon is supported while curing.

With the joists **14** and the associated form elements in place additional steel bars **44** are installed and are appropriately engaged with saddles **18.** Then after installation of a suitable peripheral concrete impervious form member, which constitutes no part of the present invention, fluid concrete **46** is placed on top of the structure to the appropriate level and is finished in accordance with conventional procedures.

After **46** has cured, spacers **36** are removed from the bottom, in certain instances such removal requiring the cutting of steel straps **38.** The spacers, because they are typically made of lumber, must be removed to provide a fire resistant structure and they can be reused numerous times. Thus, it will be seen that the completed floor and ceiling structure has openings or depressions in the bottom thereof that are suitable for containing utility lines and which depressions or cavities are lined with gypsum board. The gypsum board affords numerous advantages including thermal and sound insulation and an attractive surface if it is not desired to install ceiling boards **28.** In any event, after the utility lines are installed within the cavities the ceiling side of the floor and ceiling structure can be finished by attaching ceiling boards **28** with nails **26** driven into dove-tail strips **24.**

Thus, it will be seen that the present invention provides an extremely efficient and economical method and structure for constructing a poured concrete ceiling and floor. Because the invention permits use of gypsum board as form work, construction is expedited because the form work, since it is fireproof, need not be removed as is the case with lumber form work. Additionally, the supply of gypsum board is substantially unlimited so that the invention avoids waste of lumber. All of these advantages are achieved without sacrificing strength and/or appearance of the ceiling and floor structure formed according to the invention.

Although one embodiment of the invention has been shown and described, it will be obvious that other adaptations and modifications can be made without departing from the true spirit and scope of the invention.

What is claimed is:

1. A method for forming a floor structure comprising the steps of providing at least two parallelly spaced beams having vertical abutments that define upward facing marginal shoulders thereon, providing first and second unitary gypsum board strips having a thickness corresponding to the width of the marginal shoulders, placing the strips on the respective shoulders with the strips in substantially vertical disposed relation, providing a unitary gypsum board sheet having a width corresponding to the space between confronting vertical abutments of adjacent beams, placing the sheet on the upper edges of the strips so as to define, with said strips, an inverted channel-shaped configuration having a downwardly open concavity, supporting the medial region of the sheet with a transversely extending member contacting said sheet and the first and second strips, placing fluid concrete on top of the sheet, permitting the concrete to cure, terminating the supporting step by removing the transversely extending member and leaving said gypsum strips and sheet in place so as to create an integral structure comprised of concrete and said gypsum board strips and sheet.

2. A method according to Claim **1** wherein said supporting step comprises the steps of providing a rigid rectangular member having a length equal to the distance between the gypsum board strips when supported on the beam shoulders and mounting the rigid member between said strips in underlying relation to the gypsum board sheet.

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