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Ransome

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[54] **COMPOSITE LOAD BEARING PANELS**

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[73] Assignee: **Gordon T. Kinder**, Martins Ferry, Ohio

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[52] **U.S. Cl.** **52/598**, 52/588, 52/598, 52/599, 52/725, 52/735

[51] **Int. Cl.** **E04b 5/04**, E04c 2/26

[58] **Field of Search** 52/596–599, 724, 725, 727, 425, 612, 334, 569, 430, 574, 436, 588

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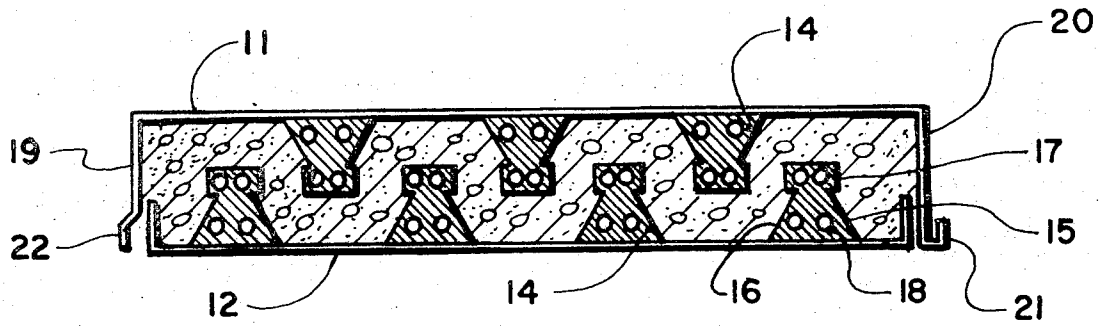
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[57] **ABSTRACT**

Composite, load bearing panels comprising two thin metal sheets, preferably mild steel, having a low density cementatious core material therebetween. Each metal sheet has a plurality of integral keys pressed angularly outward the refrom to extend into the cementatious core material. The keys of one sheet, which extend to a depth greater than 50 per cent of the thickness of the core material, are alternately spaced in relation to the keys of the other sheet and act both as a mechanical bond for the sheets and the core material and as reinforcement to the panel giving it substantial strength in both tension and compression.

7 Claims, 4 Drawing Figures



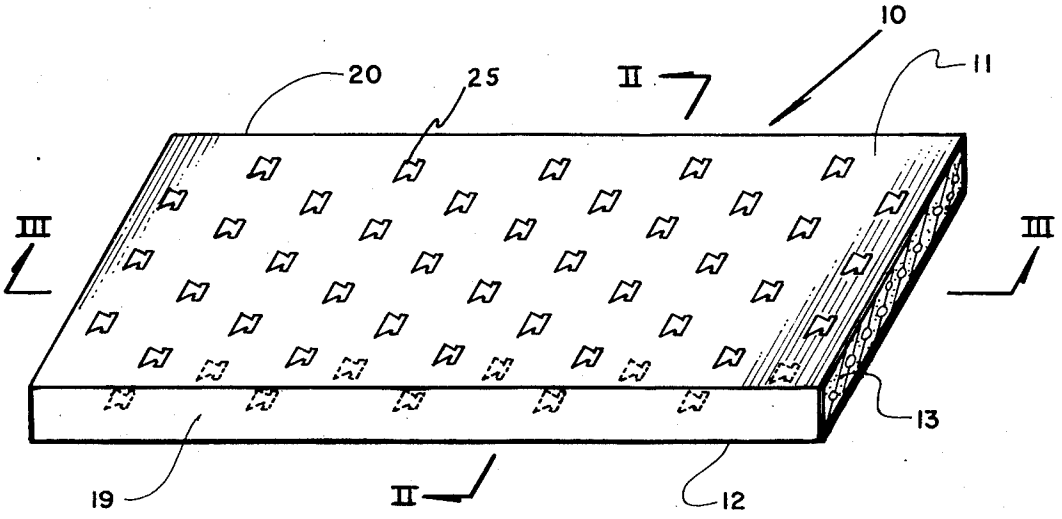


Fig. 1

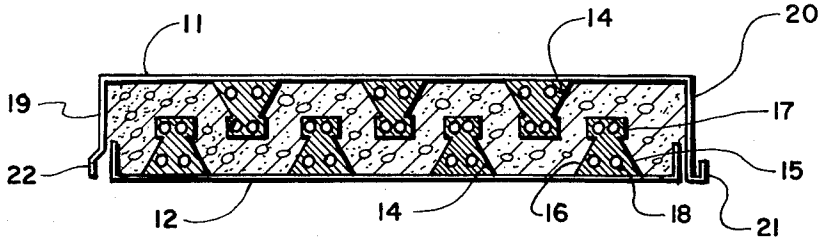


Fig. 2

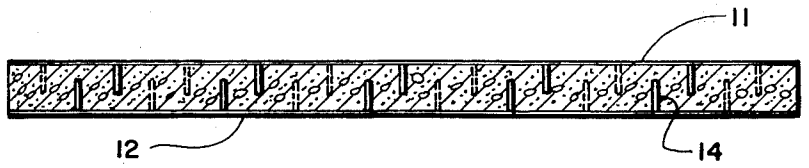


Fig. 3

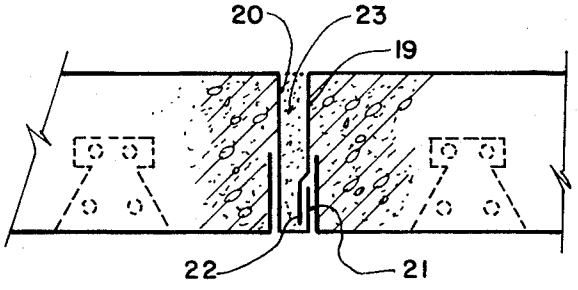


Fig. 4

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COMPOSITE LOAD BEARING PANELS

My invention relates to composite panels and, more particularly, to load bearing panels having thin metal faces and a cementatious core material therebetween.

Load bearing panels often require considerations beyond the primary requisite of sufficient strength to support a given load. These additional properties can be any or all of fire resistance, sound absorption, easy fastenability to various support members and the ability to interlock with adjacent panels to form a complete load bearing structure. Metal products such as steel plates possess some of these properties, but others such as sound absorption and fastenability are lacking. In addition, the weight of the plates often create handling problems and the cost of such plates may be prohibitive. On the other hand, various types of cementatious materials qualify for many of the secondary considerations, but because of their inherent low tensile strength, they cannot be satisfactorily used in and of themselves as load bearing panels subjected to beam type loading.

To overcome these individual problems, I have utilized the advantageous attributes of both the metals and the cementatious materials to achieve a composite panel which is structurally sound. At the same time, the panel is lightweight, highly fire resistant and can be easily made sound absorbing. Further, the panels may be easily fastened to various support members and may be interlocked with each other to form the desired structural member.

My invention is a composite load bearing panel in which light gauge sheet metal, preferably mild steel, form the panel faces which are separated by a cementations core material. A plurality of mechanical keys are pressed at an angle from the face of the sheets to form a mechanical bond between the core material and the sheets. The keys extend beyond 50 per cent of the thickness of the core material and are preferably alternately spaced in rows with respect to keys of the same face, as well as the opposing face to maximize the reinforcement of the panel.

In the accompanying drawings, I have shown my presently preferred embodiments in which:

FIG. 1 is an isometric of my composite panel;

FIG. 2 is a section taken along section lines II—II of FIG. 1;

FIG. 3 is a section taken along section lines III—III of FIG. 1; and

FIG. 4 shows the interlocking of adjacent panels.

My composite load bearing panel, generally designated **10**, includes a top face **11** and a bottom face **12** made from a metal such as mild steel and having a cementatious core material **13** therebetween, see FIG. 1. The sides **19** and **20** of the panel are merely extensions of the faces **11** and **12** and will be described in detail hereinafter.

The top and bottom faces **11** and **12**, respectively, are mechanically bonded to the cementatious core material **13** by means of a plurality of keys **14** which are integral with their respective faces and which depend outwardly therefrom at an angle into the cementatious core **13**. These keys **14** play a vital role in the overall performance of the load bearing panel **10**, for they not only anchor the composite panel in assembled relationship by mechanical bonding, but they act as reinforcers for the panel so that the panel has substantial strength in tension and compression.

The keys **14** are pressed outwardly from the metal sheets to an angle of preferably 90°. When the keys are at 90° to the faces of the panel, they prevent lateral movement of the faces in either direction under load conditions. Where the load condition will be light or in one direction only, the angularity of the keys may vary from 90°, but, of course, the 90° angularity provides an added safety factor.

The depth of the keys **14** with regard to the thickness of the cementatious core **13** is also very critical and should be greater than 50 per cent of that depth so that the keys **14** of the top and bottom faces **11** and **12** overlap. Then it is not possible to have a straight shear plane through the core material since any shear plane would be continually disrupted by the keys **14** of either or both the top and bottom sheets **11** and **12**, respectively.

In addition, the keys **14** should be staggered to optimize the reinforcing effects and the mechanical bond strength. I have found that satisfactory conditions are achieved when the keys **14** of the top face **11** and bottom face **12** are staggered and alternated in directions crosswise, as well as lengthwise of the panel **10**. For example, such a crosswise plane is shown in FIG. 2 where the keys **14** of the bottom face **12** alternate with the keys **14** of the top face **11**. The same type of alternating relationship between the keys of the top face **11** and the keys of the bottom face **12** is shown in FIG. 3 for a plane extending lengthwise of the panel **10**. This staggering of the keys **14** is easily achieved by pressing the keys **14** to form rows. The keys of one row are staggered with respect to keys of adjacent rows, see FIG. 1. Therefore, keys of every other row are not traversed by a straight lengthwise plane passing therethrough, see FIG. 3 where the rows containing untraversed keys are shown dotted.

As stated earlier, the result of the key overlap is to prevent a straight shear plane from passing through the panel. In addition, the plurality of staggered keys balances the applied load since when any two adjacent tabs are in tension, the adjacent tabs thereto are in compression.

A very satisfactory key, both for purposes of mechanical bonding and reinforcing, is one in which the sides **15** and **16** of the key **14** angle toward each other away from the metal face and terminate in a flange **17** to form a somewhat T-shaped section, see FIG. 2. As illustrated, the flanges **17** from the keys **14** of opposing faces **11** and **12** are in overlapping relationship. Mechanical bonding is further increased by punching a plurality of holes **18** in both the flange **17** and the area between the sides **15** and **16** of the keys **14**. The cementatious core material **13** fills these holes **18** as it is poured into the space formed by the metal periphery, and after solidification, the mechanical bonding is substantially increased.

The voids **25** formed in the faces **11** and **12** by the pressing out of keys **14** can be used for connecting the panel **10** with joists or other structural members utilized to support it.

The metal faces of the panel are preferably made out of mild steel sheets having an ultimate strength in the range of 30,000 psi and having a thickness between 22 and 30 gauge, inclusive. This provides adequate strength for the panel and at the same time permits easy pressing out of the keys and forming for the panel sides.

The cementatious core material **13** is preferably somewhat cellular. This reduces the weight of the

panel, increases the sound absorption, maintains fire resistance and at the same time, minimizes the cost. Although I prefer to keep the density of the cementatious core below 20 lbs./cu.ft., the density can go as high as 50 lbs./cu.ft. and still be reasonable in terms of overall panel weight. While more dense material such as concrete can be employed, I prefer the lighter cementatious materials, of which there are many, since all the desirable properties can be achieved by the use thereof. Generally speaking, the thickness of the composite panel will vary between one-half and 3 inches, depending upon the span and the load requirements of the panel.

The panels **10** can be easily interlocked with each other along the panel sides with the space therebetween filled with a grout of the core material to present a uniform surface and an equal sound and fire rating, see FIG. **4.** This can be accomplished by double bending the top metal face to form the side **20** having an upwardly extending free end **21.** An adjacent panel having a side **19** with a downwardly depending free end **22** is interlocked therewith and the space therebetween is filled with core material **23.**

It will be appreciated by those skilled in the art that within the framework of the above specification, the key depth and spacing, as well as the face gauges, core materials and densities may be varied to accommodate almost any load over any given span condition.

I claim:

1. A composite load bearing panel comprising two thin metal faces having a cementatious core material therebetween, each metal face having a plurality of integral keys positioned substantially 90° outward therefrom to extend into the core material to a depth of greater than 50 per cent of the core material thickness, the keys including a web portion extending from the metal face and terminating in a flange portion, at least one of the web portion and flange portion having a plurality of holes extending therethrough, said keys of one face being alternately spaced in relation to the keys of the other face and being in overlapping relationship so as to prevent failure by a straight shear plane, said keys acting both as a mechanical bond between the faces and the core material and as reinforcement of the panel giving said panel substantial strength in both tension and compression.

2. The panel of claim **1** wherein the webs of said keys of each sheet have sides which angle toward each other away from the metal face and terminate in the flange to define a substantially T-shaped key.

3. The panel of claim **1** wherein said keys of each face are positioned in rows crosswise of said face, the keys of a given row in each face being staggered in relation to the keys of an adjacent row, said rows of one face aligning with the rows of the other face in alternating key relationship.

4. The panel of claim **1** wherein each metal face extends outwardly at 90° along at least one edge thereof to form panel sides to encapsulate the cementatious core.

5. The panel of claim **4** wherein at least one side has a free end to accommodate a free end of an adjacent panel to form a space therebetween, said space being filled with grout.

6. The panel of claim **1** wherein the metal faces are mild steel sheets having a thickness between 22 and 30 gauge, inclusive.

7. The panel of claim **6** wherein the cementatious core material has a density less than 50 lbs./cu.ft. and preferably below 20 lbs./cu.ft.

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