Sept. 13, 1938. E. C. MARQUA 2,130,285

CEILING STRUCTURE

Filed July 19, 1937 2 Sheets-Sheet 1

Fig. 1.

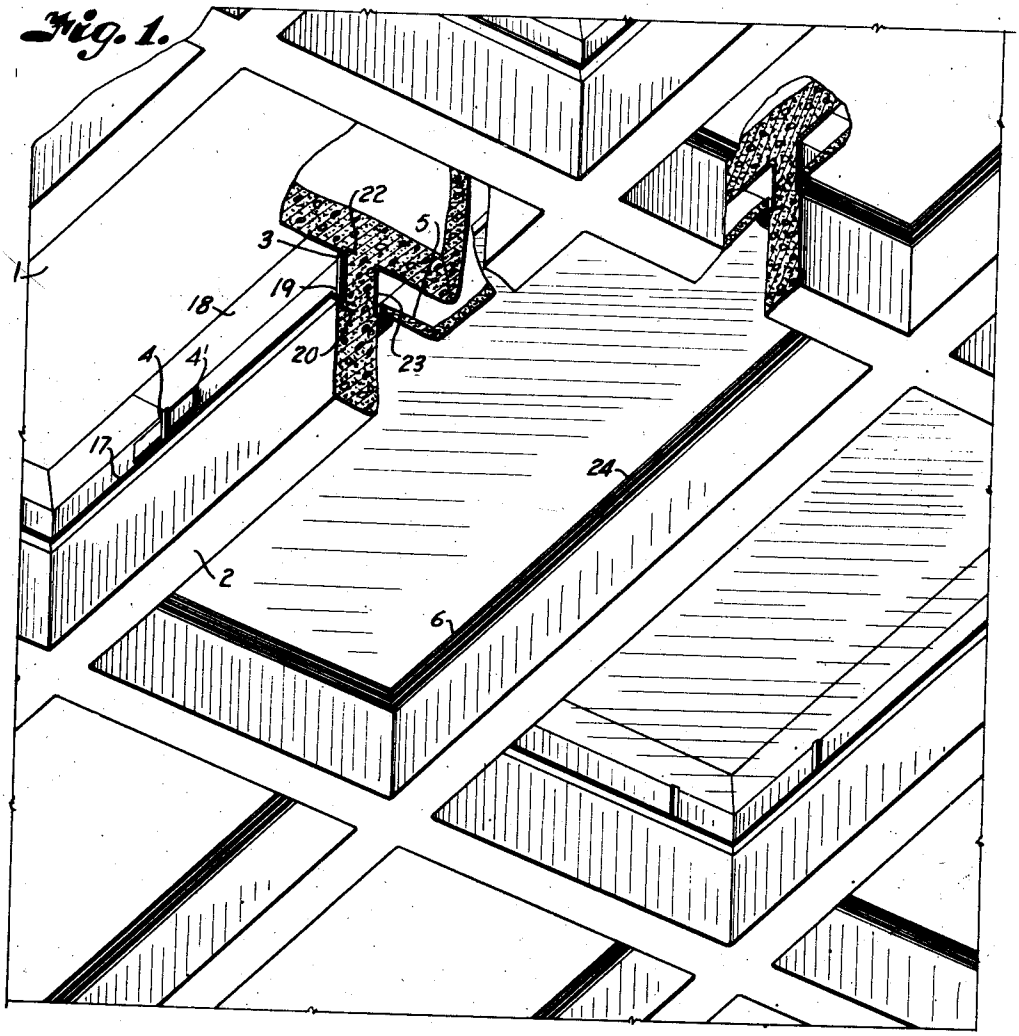
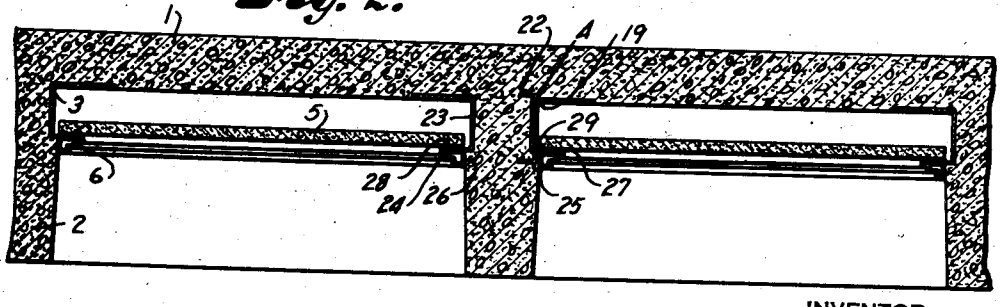


Fig. 2.



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Fig. 3.

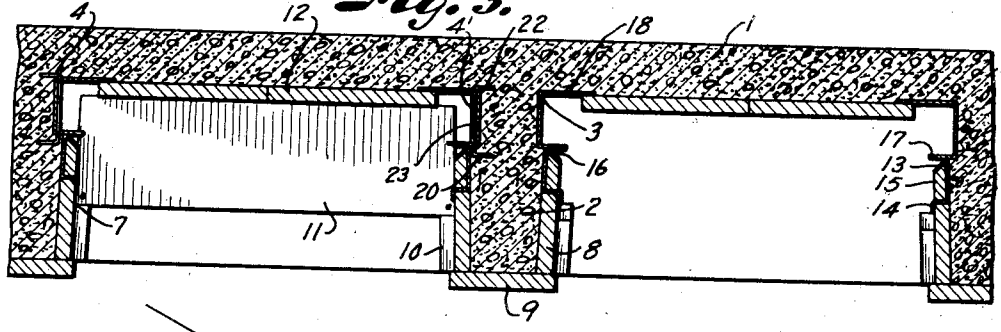


Fig. 4.

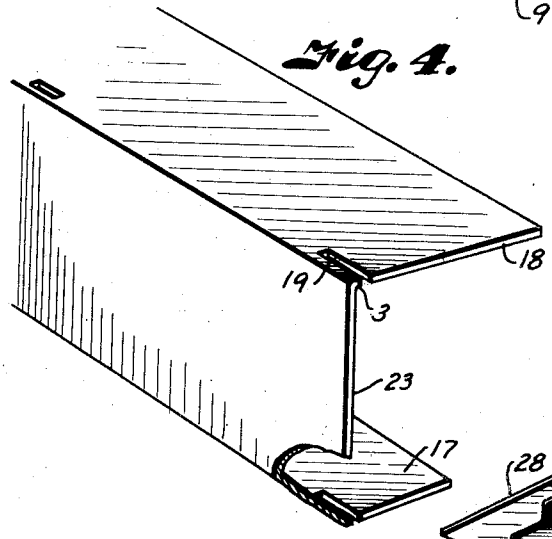


Fig. 5.

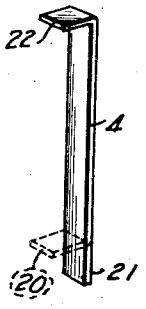


Fig. 6.

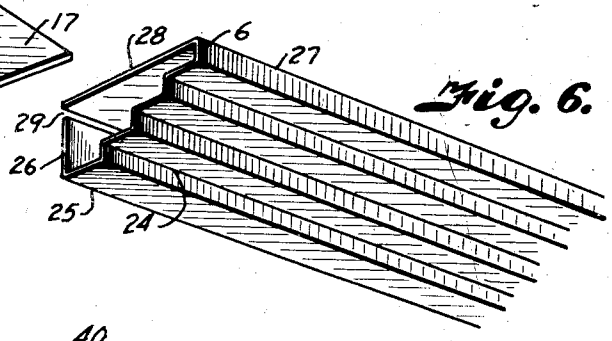
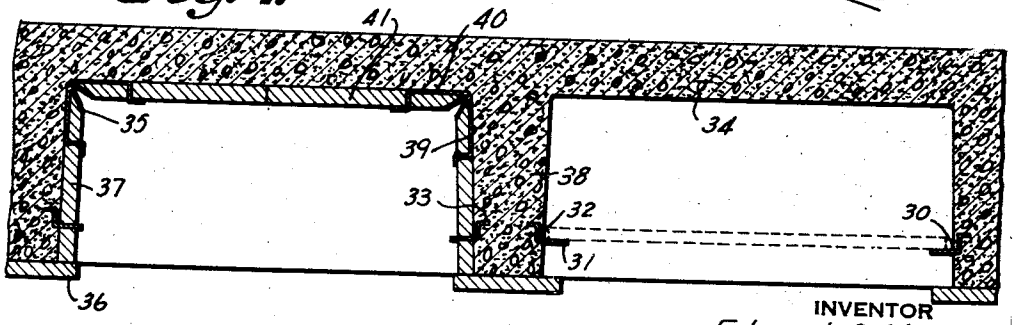


Fig. 7.



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UNITED STATES PATENT OFFICE

2,130,285

CEILING STRUCTURE

Edward C. Marqua, Kansas City, Mo.

Application July 19, 1937, Serial No. 154,416

9 Claims. (Cl. 72—71)

This invention relates to ceiling structures, and more particularly to a structure of that character adapted for absorbing sounds to correct acoustical conditions in enclosures such as auditoriums, theatres, and the like.

In modern building conditions, where large buildings are constructed with relatively great speed, it is important that the ceilings and wall structures of the buildings be susceptible of inspection to determine the strength and quality of such structures. Therefore, the use of hung ceilings and conventional acoustic treatment has been discarded for an open joist construction. Heretofore, it has been very difficult to apply acoustic treatment to a building in such a manner as to have an exposed joist. Speed of application of sound absorbing ceilings to buildings is also an element in the speed and efficiency of building conditions, and the repair and replacement of ceilings of this character is an important item in the maintenance of buildings provided with acoustically correct ceiling structures.

It is the principal object of the present invention to provide a simple, efficient and relatively inexpensive ceiling structure, which structure is ledged for adapting it to receive sound absorbing material to dampen sound vibrations and correct the acoustical conditions of the enclosure of which the ceiling structure forms a part.

Other objects of the present invention are to provide a ceiling form for supporting sound absorbing material, which form is mounted in the ceiling structure during the construction of the ceiling; to provide for differentially spacing sound absorbing material from the top wall of a room; and to provide an attractive molding cooperable with the form and sound absorbing material for enhancing the appearance of the room, the acoustics of which are being corrected.

In accomplishing these and other objects of the present invention, I have provided an improved method, together with improved details of structure in apparatus, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a bottom perspective view of a ceiling structure illustrating sound absorbing material applied to parts thereof, part of the structure being broken away to illustrate the application of my preferred form of support for the sound absorbing material.

Fig. 2 is an elevational cross-section through a portion of the ceiling structure illustrating in greater detail the sound absorbing material supporting structure.

Fig. 3 is an elevational cross-section through a portion of the ceiling structure illustrating the manner in which the top wall and joists are formed and showing the application of the supporting forms thereto.

Fig. 4 is a detail fragmentary perspective view of my preferred form of sound material supporting form.

Fig. 5 is a perspective view of an anchor for securing a form to a joist.

Fig. 6 is a detail fragmentary perspective view of a molding element for finishing the appearance of the ceiling.

Fig. 7 is an elevational cross-section through a portion of the ceiling structure illustrating a modified form of support for the sound absorbing material.

Referring more in detail to the drawings:

The invention generally consists in providing a poured concrete ceiling structure 1 with joists or the like 2 between which sound absorbing material supporting forms 3 are mounted by anchors 4, sheaths of sound absorbing material 5 being supported on the forms, and the appearance of the ceiling being enhanced by molding strips 6.

In carrying out my invention, I provide concrete forms or pans 7 preferably consisting of spaced side boards 8 mounted on suitable building centering such as soffit boards 9 and having blocks 10 secured thereto for supporting spacers 11 which in turn support top leaves 12. Mounted on the side boards 8 are sheaths 13 having preferably downwardly extending flanges 14 engaging over the upper inner faces of the side boards 8 and having side leaves 15 sleeved therein. The upper ends 16 of the sheaths 13 support the lower inwardly extending flanges 17 of the forms 3, while the upper flanges 18 of the forms, which are preferably longer than the lower flanges 17, rest upon the upper faces of the top leaves 12.

Aligned openings 19 are preferably provided adjacent to the ends of the forms 3 for extension therethrough of the anchors 4, the lower ends 20 of the anchors subsequently being bent laterally, as shown in dotted lines in Fig. 5 and in full lines at 21 in Fig. 2. The anchors 4 are provided with laterally extending top ends 22 engagable with the upper faces of the flanges 18 of the forms for seating thereon and extending laterally from the forms in a direction opposite that of the form flanges.

An auxiliary anchor plate 4' is also provided

which is adapted for engagement against the side faces of a pair of adjacent forms 3 to aid in aligning the forms end to end in the same vertical plane, the plate being mounted in anchoring position by inserting the same between the anchor 4 and the faces of the forms.

With the construction thus far described, it is apparent that a number of such structures may be suitably juxtaposed prior to the pouring of the concrete ceiling structure 1 and that when the concrete is poured, the top wall thereof is supported by the top leaves 12 and the upper flanges 18 of the forms to provide the top wall structure, the joists 2 being formed by reception of the poured concrete between the spaced pan structures.

It is here pointed out that the lower flanges 17 of the forms 3 preferably seat on the upper end 16 of the side leaf sheaths in such a manner that a rearwardly offset relation is provided for the webs 23 of the forms relative to the upper ends of the sheaths, the effect of which is to seat the forms back into the joists whereby a support is formed in the joists for the lower corners of the forms.

The ceiling and joists having been poured, the spacers 11 are suitably removed and the sheaths 13 withdrawn by inserting a tool between the flange 14 thereof and the side boards 8 and merely prying the sheaths from their position. The side boards 8 and top leaves 12 are then suitably removed and the top flanges of the forms are left in embedded condition in the top wall to form a plane surface with the top wall, the bottom flanges extending inwardly toward each other from the joists to provide a shelf upon which the sheets of sound absorbing material 5 may be seated by merely inserting one edge of the material 5 through the space between the bottom flanges 17 and continuing such insertion until the opposite edge thereof is in position to be engaged by one of the flanges, whereupon the other edge of the material need only be released for gravitational support of the sheets of material on the flanges.

Each of the moldings 6 is provided with a stepped diagonally extending body portion 24, the lower end 25 of which terminates in an upwardly extending flange 26 and the upper end 27 of which terminates in a laterally exending flange 28. A space 29 is provided beween the ends of the flanges by means of which the upper flange 28 may be sleeved over the lower flanges 17 of the forms 3 for supporting the moldings thereon, whereby the appearance of the ceiling is enhanced.

In Fig. 7 I have shown a modified form of invention wherein brackets 30 consisting of horizontal flanges 31 are connected with substantially vertically extending flanges 32 having rearwardly and laterally extending lips 33. The brackets 30 are adapted for use when sound absorbing material is designed to be spaced a greater distance from the top wall 34 than when used with the forms 3 described in connection with my preferred form of invention, the manner of application of the sound absorbing material, however, being substantially the same in both instances.

In using the modified form of sound absorbing material supporting brackets, concrete pouring pans 35 are mounted in suitably spaced relation on soffit boards 36 of suitable building centering, which pans preferably consist of pairs of side boards 37, between which the flanges 31 of the brackets are inserted, the upwardly extending flanges 32 and the lips thereof preferably projecting upwardly and outwardly from the other sides of the pans and being adapted to be anchored in the joists 38 of the ceiling when the concrete is poured between the spaced pans. In the present instance, while side leaf sheaths 39, similar to the sheaths 13 previously described, are provided for the side walls of the pans, top leaf sheaths and boards 40 are provided adjacent the top leaves 41 of the pans to take the place of the forms 3 in providing shapes for the corners between the top wall and joists therefor.

The principal advantages in the invention which I have provided over other ceiling structures heretofore available are that the sound absorbing material may be easily and quickly removed which greatly facilitates the inspection or repair of the top wall or joists of the ceiling. The sound absorbing material supporting forms are adequately anchored in the ceiling structure at the time the ceiling is poured, thereby increasing the speed with which the building can be constructed and consequently reducing the cost thereof. The supporting forms are adaptable for any desired spacing from the top walls of the ceiling structure; and further, an attractive acoustically correct ceiling is provided for a building enclosure. It is also my belief, due to the favorable results obtained with the present invention, that the provision of the open joist work for the ceiling structure deflects the sound waves to be absorbed in upwardly inclined angles into the sound absorbing material and therefore avoids deflection of such waves downwardly back into the enclosures in which the present ceiling structures are mounted.

What I claim and desire to secure by Letters Patent is:

1. In combination with a ceiling structure, a form adapted to be mounted in said structure including a web having laterally extending flanges, said flanges having openings therein adapted to receive an anchoring member engageable in said structure for anchoring the form relative to the structure, and a molding member adapted to engage one of the flanges of said form for supporting the molding member relative to the ceiling structure.

2. In combination with a ceiling structure, a form adapted to be mounted in said structure including a web having laterally extending flanges, said flanges having openings therein adapted to receive an anchoring member engageable in said structure for anchoring the form relative to the structure, an anchoring member, and a molding member adapted to engage one of the flanges of said form for supporting the molding member relative to the ceiling structure.

3. In combination with a ceiling structure, a form adapted to be mounted in said structure including a web having laterally extending flanges, said flanges having openings therein adapted to receive an anchoring member engageable in said structure for anchoring the form relative to the structure, an anchoring member, a molding member adapted to engage one of the flanges of said form for supporting the molding member relative to the ceiling structure, and sound absorbing material mounted on one of said flanges.

4. In combination with a ceiling structure, a form adapted to be mounted in said structure including a web having laterally extending flanges, said flanges having openings therein adapted to receive an anchoring member engageable in said structure for anchoring the form relative to the

structure, an anchoring member, and a molding member having right angularly disposed spaced flanges adapted to receive one of the flanges of said form therebetween for supporting the molding member relative to the ceiling structure.

5. In combination with a poured concrete ceiling structure, a form adapted to be mounted in said structure at the time of pouring thereof including a web having laterally extending flanges, said flanges having openings therein adapted to receive an anchoring member engageable in said structure for anchoring the form relative to the structure, an anchoring member, and a sheet of sound absorbing material having edge support on one of said flanges.

6. A ceiling structure including a wall having joists, a form adapted to be mounted in the wall and joists for supporting sound absorbing material, sound absorbing material, means for anchoring the form in the wall and joists, and a molding member having a portion thereof engageable with and interposed between the form and sound absorbing material and covering portions of the form and sound absorbing material.

7. In combination with a ceiling structure, a form adapted to be mounted in said structure including a web having laterally extending flanges, the web and one of the flanges being embedded in the ceiling structure, the other flange extending outwardly from the ceiling structure, and sound absorbing material supported on said outwardly extending flange.

8. In combination with a ceiling structure, a form mounted in said structure including a web embedded in the structure having spaced laterally extending flanges, said form having openings therein adapted to receive an anchoring member, and an anchoring member having flanges engageable in said openings and embedded in said structure for anchoring the form relative to the structure.

9. In a ceiling structure of the character described, a wall having joists, a form mounted in the wall and joists at the juncture thereof, and means on the form in vertically spaced relation to the wall and lower ends of the joists, said means extending laterally of the joists and being adapted for removably mounting sound absorbing material thereon.

EDWARD C. MARQUA.