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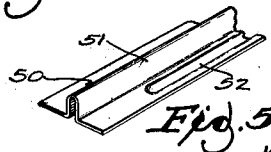
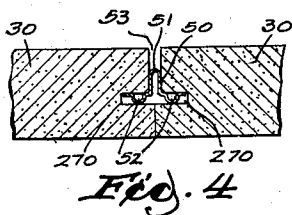
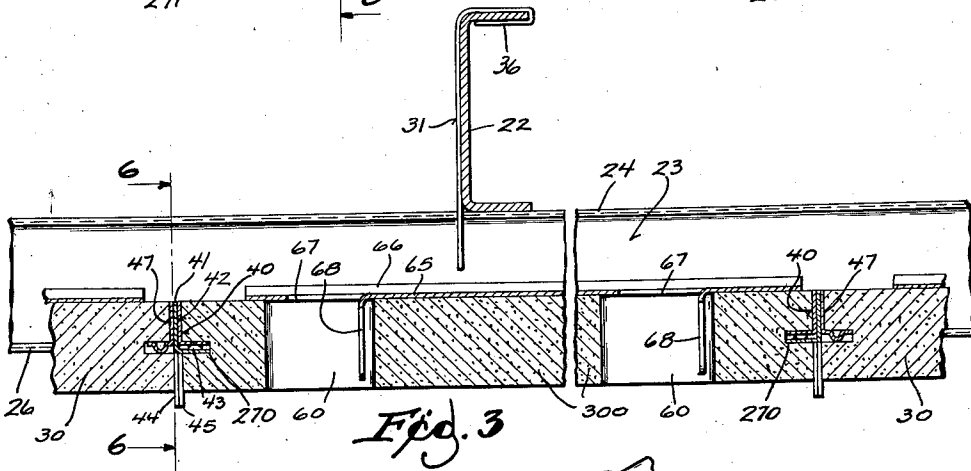
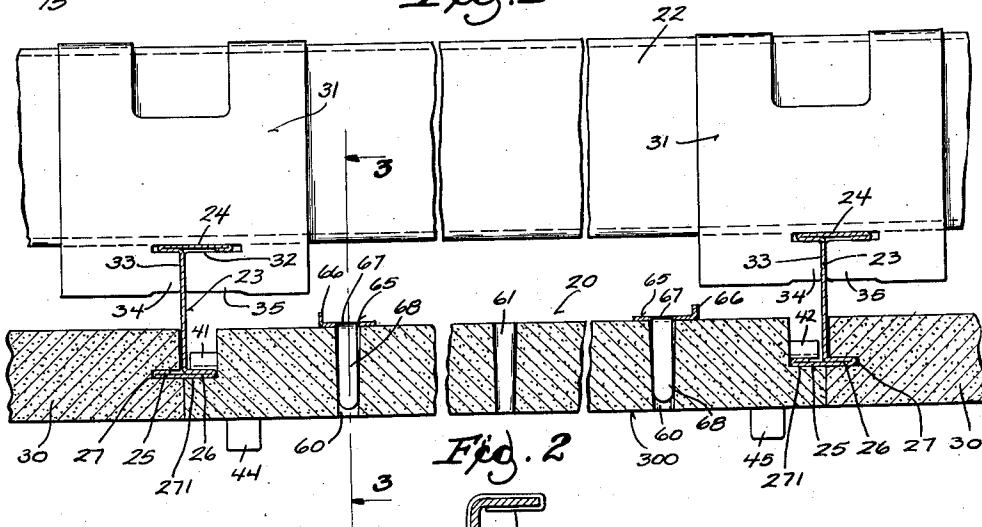
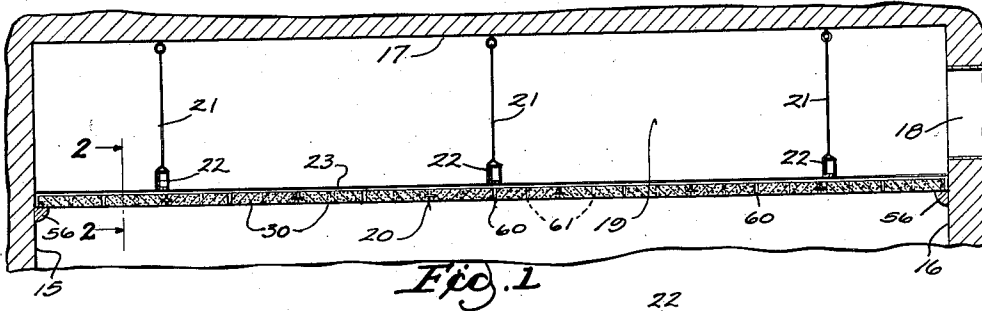
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2,807,993

VENTILATING CEILING CONSTRUCTION

Filed Jan. 3, 1955

2 Sheets-Sheet 1



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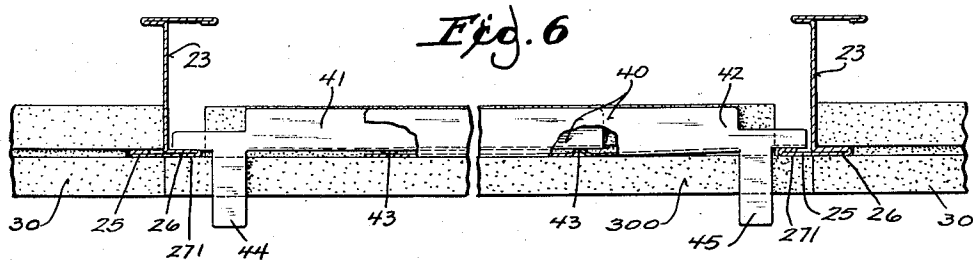
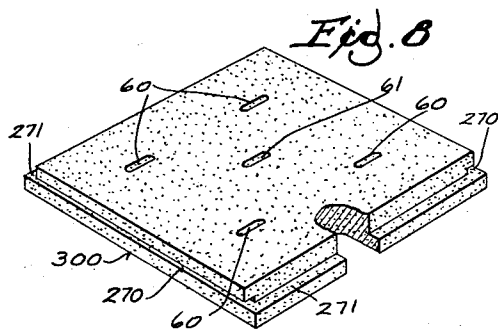
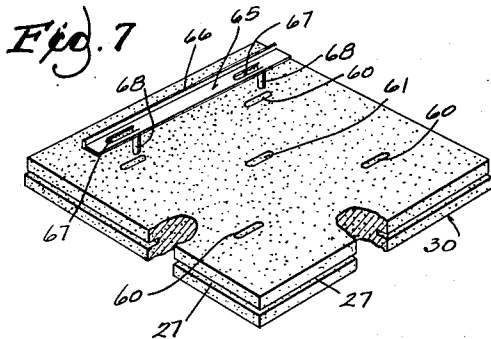
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2,807,993

VENTILATING CEILING CONSTRUCTION

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8 Claims. (Cl. 98—40)

This invention relates to a ventilating ceiling construction.

Numerous attempts have been made to devise ventilating or air conditioning systems using a ceiling plenum chamber with means for permitting a flow of air through the ceiling into the room to be ventilated or air conditioned. The unsolved problem in such installations has been an adequate, comprehensive control of air flow to eliminate draft. The requirements vary in every installation according to the location, or absence of, windows, doors and other openings. Even furniture locations affect the requirements.

The present ceiling is desirably constructed of tile, one feature of the invention comprising retractable interlocking means which makes certain tile removable to give access to others to the end that any portion of the ceiling may be separable as desired.

More fundamentally, however, the invention is concerned with a simple, inexpensive means invisible to the ordinary person using the room but readily accessible from beneath the ceiling to regulate air flow through all portions of the ceiling so that draft-free movement can be tailored to the particular requirements of the installation. In the preferred embodiment of the invention, each tile has a pattern of slots which taper downwardly in the cross section of the opening and at least most of which are controlled by simple, inexpensive slides mounted on the top surface of the tile and having operating tongues depending in the slot and serving not only to permit the slides to be operated from beneath, but also providing guidance for the slides. The control is effected by varying the extent to which the slot in the slide, formed by stamping out the tongue, registers, or fails to register, with the slot in the ceiling.

Through the arrangement described, an operator can use any pointed instrument, such as a nail or an ice pick, to reach into a slot and manipulate the tongue depending from one of the slides to move the slide to open or close that particular slot and any other controlled by the same slide.

In the drawings:

Fig. 1 is a fragmentary view in cross section through the upper portion of a room provided with a ceiling embodying the present invention.

Fig. 2 is a view on an enlarged scale taken in section on the line 2—2 of Fig. 1.

Fig. 3 is a view taken in section on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary detail view in 10 cross section through a preferred spline used between tile.

Fig. 5 is a fragmentary detail view of the spline in perspective.

Fig. 6 is a view taken in section on the line 6—6 of Fig. 3.

Fig. 7 is a view in perspective showing a single tile with portions broken away and one of the control valve slides shown in slightly raised position.

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Fig. 8 is a view in perspective of a modified form of tile used where access to the plenum is required.

Fig. 9 is a view in perspective showing in slightly separated positions the complementary parts of an extensible support for the modified tile of Fig. 8.

Fig. 10 is a fragmentary detail view on an enlarged scale of the edge portion of a thin tile showing a reinforcing angle.

Fig. 11 is a fragmentary detail view in perspective of a portion of such a reinforcing angle.

Fig. 12 is a fragmentary bottom plan view of a portion of a ceiling completed in accordance with the present invention.

The room fragmentarily illustrated in Fig. 1 comprises the usual side walls 15, 16 with a ceiling 17 immediately below which opens the air supply duct 18 which delivers ventilating air, heated air or cooled air, as the case may be, into the plenum chamber 19 above the false ceiling 20 with which the present invention is primarily concerned.

Ties 21 connected to the ceiling 17 at suitable intervals support channels 22 at any suitable spacing which, for example, may be four feet between centers. The ceiling tile hereinafter to be described are connected with joist elements 23 which are of I-beam cross section but are extremely lightweight, being molded of thin sheet metal as best shown in Fig. 2. The upper end portion 24 of each joist snugly abuts the several channels 22. The lower portion of each joist comprises laterally projecting flanges 25 and 26 formed by folding the sheet metal upon itself, these flanges being received into kerfs 27 of the tile 30.

The joists 23 are supported by special clips 31, each of which has an opening at 32 to receive the top of the joist, the clip being slit at 33 from such opening to its lower margin to provide tongues 34 and 35 which abut the central webs of the respective joists. With the clip engaged with the joists as shown in Fig. 2, its upper end portion 36 is folded over the stringer channel 22 to hold the joist securely against the channel as shown in Fig. 3.

If the several tile are all assembled by sliding them into place with their respective kerfs engaged over flanges 25 of the supporting joists, access to the plenum is obtainable only by disassembling the entire ceiling or destroying one or more tile and substituting a makeshift replacement. Accordingly, it is one of the features of the invention to provide for opening the ceiling at any appropriate intermediate point. To this end, special tile 300 are provided as shown in Figs. 6 and 8, and incidentally illustrated in Figs. 2 and 3. The tile 300 has grooves 270 along two of its sides, but a shoulder 271 is exposed by opening up each groove 27 at the other two sides of the tile by removal of the portion of the tile thereabove. As best shown in Figs. 2 and 6, the exposed shoulders 271 engage the joist flanges 25 and 26 from beneath, but the tile are not supported by engagement of any portion of the tile 300 with the upper surfaces of the respective joist flanges. Thus, but for some other means of support, the tile 300 would fall from its illustrated position between the joists 23 in Fig. 6 and Fig. 2.

The supports 40 separately illustrated in Fig. 9 and shown in side elevation in Fig. 6 comprise a pair of relatively extensible angle slides 41 and 42 desirably embossed at 43 for bearing contact with each other and having depending tongues 44, 45 for their manipulation. These tongues hang down between the tile at opposite sides of the tile which is removable.

The horizontal flanges of the angle slides 41 and 42 fit into the grooves 270 of the removable tile 300 at opposite sides thereof. With the slide elements 41 and 42 extended, their ends overlie flanges 26, 25 of respective joists 23 to support the tile. When such elements are relatively retracted, their combined length is less than the

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space between the flanges of the joists, thereby freeing the tile for removal. An operator grasping the depending tongues 44, 45 can readily manipulate the slides for extension or retraction to mount the tile 300 or to free it from support from the flanges of the joist elements, as may be desired.

Where the supports 40 are used to carry a removable tile 300, the adjacent margin of tile 30 is desirably reinforced by an angle 47 as best shown in Fig. 3. This is required only when the tiles are relatively thin and it serves to keep the tile 30 from sagging by providing marginal support comparable to that provided for tile 300 by the lapping and relatively slidable angles 41, 42.

For transversely interlocking thin tiles 30 at other points, a reinforcing strip 50 may be used. The preferred construction is shown in Figs. 4 and 5, the strip having an embossed central rib 51 of substantial height and its lateral flanges having elongated ribs 52 which closely fit into the kerfs 270 of contiguous tile. It will be noted that there is marginal clearance above these kerfs at 53 on all four sides of each of the tile (see Fig. 7) to accommodate the ribs 51 of these inserts.

Where very thin tiles are used, it may also be desirable to reinforce the tile where these are cut away at the exposed shoulders 271, as shown in Fig. 10. A reinforcing strip 54 may be applied to the remaining margin of the tile and anchored by lateral tongues 55 forced into the material of the tile as shown in Figs. 10 and 11.

The joists between the ceiling and the side walls may be made as disclosed in my copending application Serial No. 256,574 or a simple piece of quarter round or other molding may be used, as shown at 56 in Fig. 1, the closure at this point being immaterial to the present invention.

In order to control air flow downwardly through the ceiling 20 from plenum chamber 19, the entire ceiling 20 is provided at relatively short intervals with openings 60 and 61 which desirably take the form of elongated narrow slots downwardly tapering in cross section, as best shown in Fig. 2. The form and relative size of the tile or other ceiling material is irrelevant to this phase of the invention, but whatever the size and shape of the tile or ceiling sheets, it is desirable that a plurality of slots 60 be aligned to be controlled by the single valve. Other slots 61 may be left open, the flow to these representing the minimum flow desired, irrespective of control. Assuming that the tile are square, as shown, each may be provided with five slots comprising two pairs of aligned slots 60 and one central uncontrolled slot 61.

The slide valve 65 comprises a plate of sheet metal desirably having an upturned flange at 66 to stiffen it and having slots at 67 spaced to register with the slot-like ports 60 which the valve is to control. Obviously, the number of slots 67 in the valve plate 65 should correspond to the number of slots in the ceiling which the plate controls, two being illustrated. The metal punched from each of the slots 67 is formed downwardly to comprise a tongue 68. These tongues are of such a length that they can readily be reached from a point below the ceiling for the manipulation of the slide. They are of such a width that at their lower ends they fit quite closely the downwardly converging side surfaces of the ceiling slots 60, whereby friction between the tongues and the material of the ceiling will tend to prevent displacement of the slides from adjusted position. The fit is not so tight as to preclude ready adjustment manually when a nail or an ice pick or a similar pointed instrument is inserted into the ceiling slot 60 from below and engaged with one of the tongues.

Two tongues engaged in slots elongated in the desired direction of slide movement are all that are needed for plate guidance.

According to the position to which the tongue is manipulated in this manner, the ports 67 in the slide valve 65 may be substantially in registry with the port 60 in the ceiling or may be substantially wholly out of regis-

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try with the ceiling ports. In all movement of the slide valve, the engagement of the tongues in a plurality of consecutive and aligned slots will guide the reciprocation of the valve to maintain it in a position where its ports will be aligned at all times against lateral displacement with respect to ceiling ports. Thus the only way in which ceiling ports can be opened or closed is by slide movement in a direction which is longitudinal of the ceiling slots.

As shown in Fig. 12, the entire ceiling may comprise a regular pattern of tile, all of which may, if desired, have permanently open ports at 61 and each of which desirably has ports 60 in aligned pairs, each spanned by one of the slide valves 65. Thus each such pair of ports 60 is individually controllable by its own valve to regulate flow independently of flow through any other pairs of ports. By having each valve arranged to control at least two ports, guidance for its movement is assured by the controlling and guiding tongues 68. By limiting the number of ports to two, control is much more localized than would be the case if longer valve slides were used to control a greater number of ports.

With a ceiling installed as here disclosed, air flow can be regulated as minutely as may be desired, the individual slide valve being opened or closed to meet the requirements of the particular room in which the system is used and to maintain, regardless of obstructions or openings, a substantially uniform downward flow of air from the entire ceiling area.

It will be understood, of course, that the air delivered into the room has to escape from it in some manner and will ordinarily be recirculated through return ducts in the conventional way.

It should be noted here that the invention is applicable to metal tile as well as tile made of acoustical or insulating material such as gypsum or fiber glass. Moreover, in a separate embodiment of the invention which is to be the subject matter of a companion application, the ports and valves are incorporated in structure interposed between successive tiles.

I claim:

1. In a building structure the combination with a plenum chamber to which air is delivered and which has a lower and generally horizontal wall comprised of many panels having their lower surfaces exposed to constitute a ceiling, each of the several panels being provided with air flow slots elongated in corresponding directions, of a valve plate slidably supported on the upper surface of each such panel and having portions movable between slot-covering and slot-exposing positions and having tongues depending in the said slots of the ceiling panels and upon which said plates depend for actuation and guidance from below the ceiling to effect plate movement between said positions, each plate having at least two tongues confined between the sides of said elongated slots, and said ceiling constituting means for controlling and distributing air flow from the plenum chamber.

2. The combination set forth in claim 1 in which the said tongues comprise material of said plate punched from the slots of said plate.

3. The device of claim 1 in which the slot of the ceiling panel has downwardly converging side surfaces to which the ends of said tongues are closely fitted.

4. The ceiling set forth in claim 1 in which each said valve plate has slots corresponding in spacing and capacity to the slots of respective panels and registrable therewith, the tongues being integrally connected with the plate at the ends of respective slots and being no longer than the thickness of the panels, whereby to lie within respective slots.

5. In a ventilating ceiling having a plenum chamber through which air is delivered, a multiplicity of ceiling tiles constituting the bottom of said chamber and having their lower surfaces exposed to constitute the ceiling, each such tile being provided with at least two slots elon-

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gated in corresponding directions, and a valve plate bearing and supported on the top surface of said tile, said plate having valve portions movable between slot covering and slot exposing positions for the control of air flow, the said plate having depending operating and guiding means extending into the respective slots and in bearing engagement with side wall portions thereof and upon which the plate is wholly dependent for guidance in its movement between said positions.

6. The combination set forth in claim 5 in which the said slots of the panel have side wall portions which are downwardly convergent toward the lower ends of the said means and in close proximity to the means at the ends thereof whereby closely to confine said means for the substantially rectilinear movement of the valve plate between said positions.

7. The combination set forth in claim 5 in which the operating and guiding means aforesaid comprise tongues integral with the plates and of such length as to lie wholly within the thickness of the panel when the plate rests on the upper surface of the panel.

8. The combination set forth in claim 7 in which the

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tongues formed integrally from the plate project at the ends of slots remaining in the plate following the forming of said tongues, the tongues being at corresponding ends of the said slots and the said slots being registrable with the slots of the panel in greater and lesser degree as the valve plate moves between said positions guided by said tongues as the tongues move in the slots of the panel.

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