

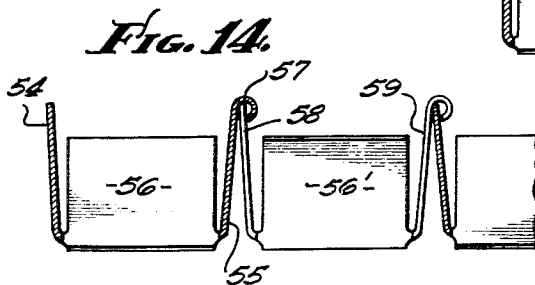
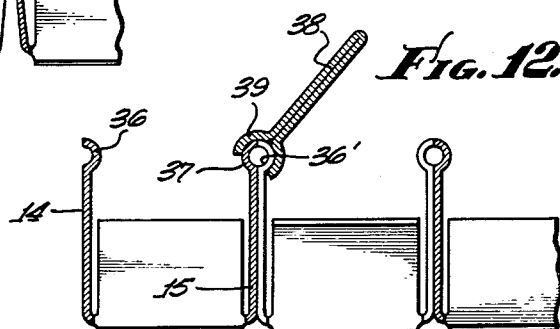
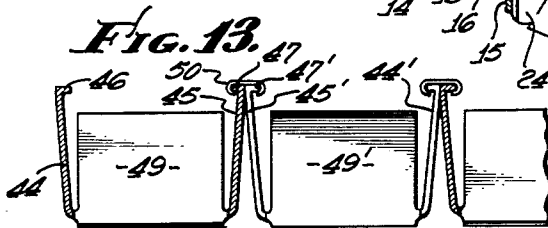
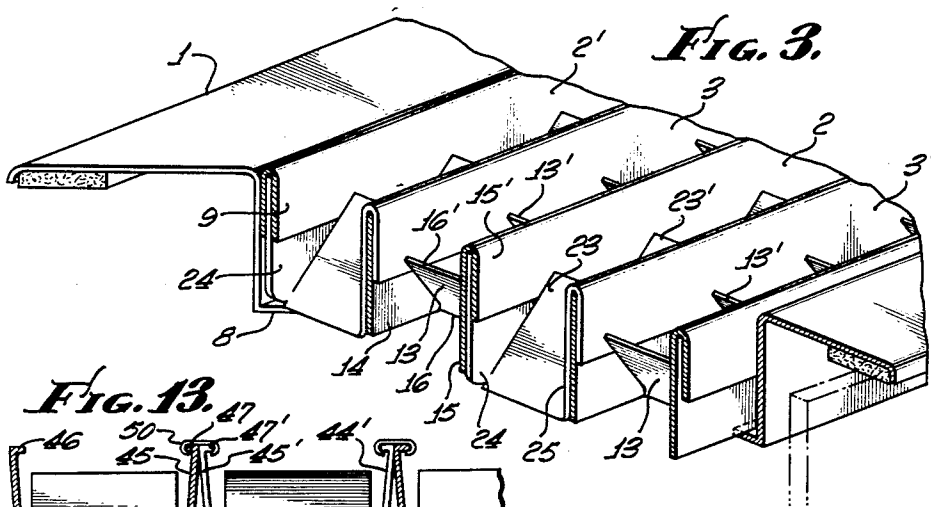
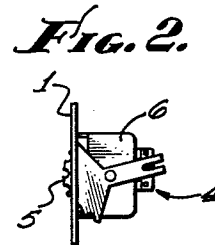
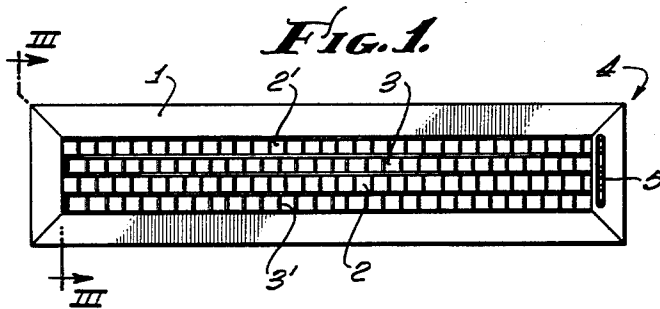
June 14, 1960

R. R. LAMBERT
MODULAR GRID CONSTRUCTION

2,940,376

Filed March 31, 1958

2 Sheets-Sheet 1



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June 14, 1960

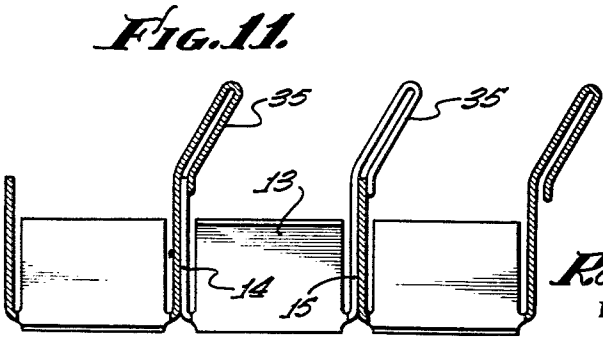
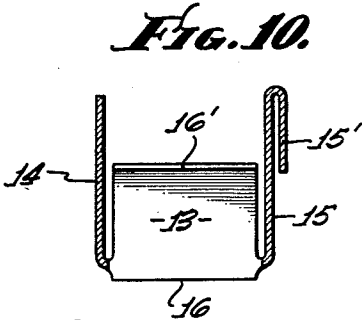
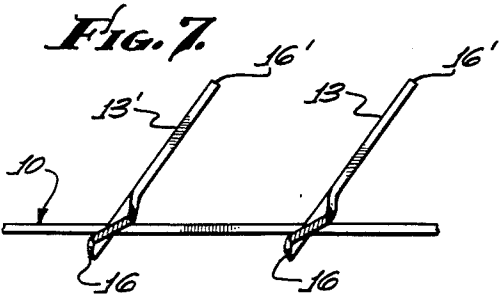
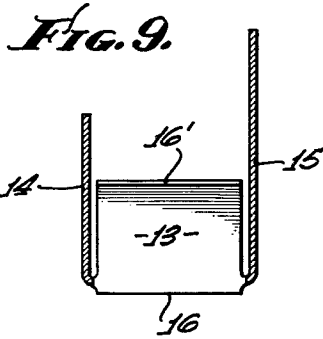
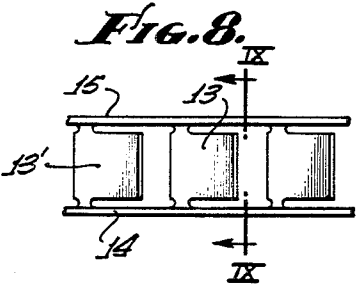
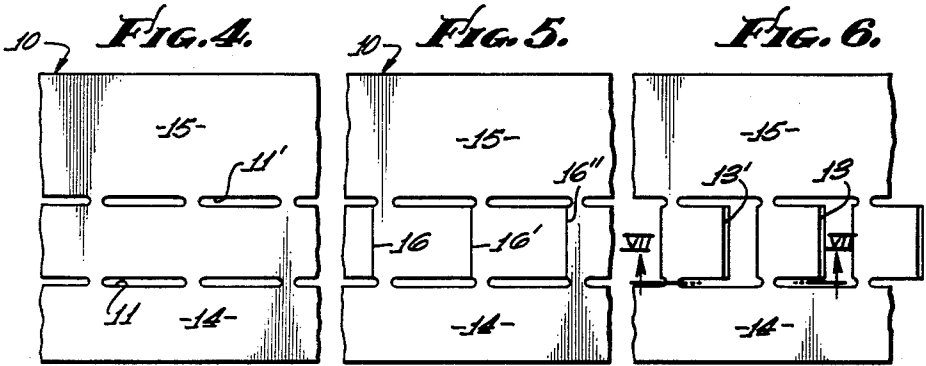
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2,940,376

MODULAR GRID CONSTRUCTION

Filed March 31, 1958

2 Sheets-Sheet 2



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2,940,376

MODULAR GRID CONSTRUCTION

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Filed Mar. 31, 1958, Ser. No. 725,086

14 Claims. (Cl. 98—40)

This invention is primarily directed to a directional, diffusing, outlet grid assembly for use in conjunction with heating, ventilating and conditioning systems, and to a modular strip element for use in such outlet assemblies.

The distribution, dissemination and return of air for controlling the heating, cooling and ventilation of residences, office buildings and other structures require a large number of supply openings and return openings in communication with supply ducts and return ducts. Various types of grilles or grids are used across such openings for the purpose of masking them and at the same time directionally distributing the air. These openings vary in size, depending upon the pressures employed in the system, the size of the rooms, the location of the openings and the purpose to be attained. Heretofore, a large proportion of these various grids were custom-built, and therefore expensive. The present invention is particularly directed to a method of manufacturing a resulting modular strip element which can be used in constructing diffusing outlet grid assemblies capable of fitting practically any sized opening. As a result, the same modular strip element may be used in a great variety of frames, grids and outlets, thereby materially reducing the cost.

Moreover, the modular strip element of the present invention provides a variety of shapes and permits many results to be attained. It provides the equivalent of an ordinary egg-crate construction wherein wall sections lie in planes parallel to the normal or axial flow of air from an opening and thereby straighten such air flow and prevent undue turbulence, and also include vanes which actually impart direction to the air currents and permit diffusion of the air over a large area, permit thorough mixing of air being supplied to a room with the air of the room without subjecting the occupants to undue drafts, and permit a single outlet to take care of a much larger volume of space than an ordinary grille.

Generally stated, the modular strip element is made from a strip of sheet metal which is punched, lanced and bent so as to form a channel-like element having substantially parallel, longitudinally extending, side wall sections and a plurality of vanes positioned between such wall sections and lying in planes transverse to the wall sections and inclined to the longitudinal axis of the strip. These various strips can then be arranged in substantially side-by-side relation so as to form an outlet grid or diffusing outlet which, when mounted in a suitable frame and positioned in a plane across the supply opening, properly directs and diffuses the air into the room or other enclosure. By varying the depth of the side-wall sections, additional louvres or vanes may be produced, these vanes or louvres further deflecting or directing the air supplied to a room.

An object of the present invention, therefore, is to disclose and provide a modular strip element made from a single strip of sheet metal and including spaced, sub-

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stantially parallel, side-wall sections and integral, inclined vanes between such sections.

A further object of the invention is to disclose and provide a preformed, metallic, strip element including a pair of virtually parallel, longitudinally extending, spaced wall sections and a plurality of vanes positioned between the wall sections and lying in planes transverse to the wall sections and inclined to the longitudinal axis of the strip, the pair of wall sections and intervening vanes being integral.

Moreover, a further object of the invention is to disclose a modular strip element including wall sections and intervening vanes and provided with interlocking means whereby adjacent strips may be rapidly connected together.

A still further object is to disclose and provide modular strip elements and grid outlet assemblies made therefrom which are capable of effectively diffusing the air, such modular strip elements being readily and economically manufactured for use in assemblies fitting a great variety of outlets varying in size.

These and various other uses, advantages and objects of the present invention will become more apparent from the subsequent description. For purposes of illustration, reference will be had to the forms of the invention shown in the appended drawings, wherein:

Fig. 1 is a plan view of a perimeter outlet often used in floors for the distribution of hot or cold air.

Fig. 2 is an end view of the perimeter outlet illustrated in Fig. 1.

Fig. 3 is an enlarged, transverse view taken along the plane III—III of Fig. 1 (portions of the device being removed) illustrating four of the modular strip elements as used in such outlet.

Fig. 4 is a plan view of a portion of a strip of metal illustrating an initial forming step; Fig. 5 is a similar plan view illustrating a second forming step; Fig. 6 is a similar plan view of a strip of sheet metal illustrating a third forming step.

Fig. 7 is an enlarged section taken along the plane VII—VII in Fig. 6.

Fig. 8 is another plan view of the strip illustrating the side wall sections in a bent condition.

Fig. 9 is a transverse section taken along the plane IX—IX in Fig. 8.

Fig. 10 is a transverse section illustrating a final step in the formation of a modular strip element of the character used in the device shown in Fig. 3.

Fig. 11 is a transverse section taken through two adjacent strip elements of a somewhat different formation and contour.

Fig. 12 is a transverse section taken through a pair of adjacent strip elements of a still further modified form.

Figs. 13 and 14 are transverse sections through adjacent strip elements, illustrating still further modifications of the present invention.

It is to be understood that the modulator strip elements described herein may be employed in making a great variety of grilles or outlets, differing in size and function. For purposes of illustration, Fig. 1 shows a floor perimeter outlet whose essential elements comprise an outer frame 1 containing four typical modulator strip elements indicated generally as 2, 3, 2' and 3' and a valve or damper assembly generally indicated at 4 controlled by a segment wheel 5 and including longitudinally extending damper elements 6 which may be opened or closed by operation of the segment 5, thereby permitting or closing off the flow of air through the outlet. The frame 1 is generally made of sections joined together at 45° angles at the corners and the enlarged view, Fig. 3, is taken along one of the 45° angle corners and then along the ends of the various modulator elements 2, 3, 2' and 3';

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portions being broken away and the valve or damper assembly being left off. In order to emphasize the distinction between adjacent strip elements, the ends of strip elements 3 and 3' are shown hatched. It will be noted that strip elements 3 and 3' are identical; each of these strip elements includes a plurality of inclined vanes 13, 13' and the like. Strip elements 2 and 2' are identical but their vanes 23, 23' and the like are inclined in an opposite direction to the inclination of the vanes 13 and 13'.

In order to simplify description, one of these strip elements, namely, the strip element 3 will be described in detail. The strip element 3 is made from a continuous strip of sheet metal and includes a pair of longitudinally extending, spaced, wall sections 14 and 15 interconnected by the intervening vanes 13 and 13'. Each of the vanes includes a rear edge, such as 16, and a front edge 16'. Each of the vanes is an integral part of the side walls and is connected to the side walls adjacent the rear edge 16. In the form of modulator strip illustrated in Fig. 3, the wall 14 is of relatively shallow depth (from front to back) whereas the wall section 15 is of greater depth, the terminal edge portion of such wall section being folded over, as indicated at 15'. In this manner an interlocking connection is provided between adjacent modular strips. Modular strip 2, for example, has parallel, longitudinally extending, spaced wall sections 24 and 25 and wall section 24 is embraced by and connected to the wall 15 of strip 3 by the overfolded portion 15' of the wall section 15. These longitudinally extending modular strip elements 2, 3, 2' and 3' may be of any length, depending upon the size of the frame or opening.

By referring to Figs. 4 to 10, inclusive, a method of manufacturing these modulator strips will be described. A strip of sheet metal, generally indicated at 10, of suitable gauge, is first perforated by two aligned rows of perforations 11 and 11', these perforations having rounded ends and being preferably of a width approximately two or more times the thickness of the sheet metal. The two parallel rows of perforations are spaced a distance equivalent to the width of the vanes to be formed; the perforations of one row are laterally aligned with perforations in the other row; the perforations in each row are spaced from each other a distance approximately three to six times the gauge or thickness of the strip material. As is more clearly disclosed hereinafter, the depth of the side wall portions of a modular strip may vary in that such side wall portions may be of equal depth or of unequal depth. Inasmuch as the manufacture of the illustrative strip 3 is to be referred to herein, the row of perforations 11 is shown closer to the longitudinal edge on one side than the spacing of the row of perforations 11' from the opposite longitudinal edge; the distance or the material separating the row of perforations 11 from its edge will eventually result in a side wall portions 14, whereas the material separating the row of perforations 11' from its longitudinal edge shall form the side wall portion 15 and its extension 15'.

As shown in Fig. 5 this perforated strip is now slit or cut as indicated by lines 16, 16', 16'', etc., so as to connect the perforations 11 and 11', the cut preferably being made adjacent one rounded end of the perforations. The strip is then passed through a forming die wherein the vanes 13, 13' and the like (metal between successive slits) are bent out of the strip and placed at a desired angle, generally at an angle of between 30° and 60°. By referring to Fig. 7 it will be noted that the vane 13 is now connected to the body of the strip material 10 by a twisted joint or portion of metal which existed between a line of adjacent perforations of the row. The vane is planar and is provided with the forward edge 16' and the rear edge 16. As shown in Fig. 8, the side wall sections of the strip are then bent upwardly around the vanes into virtually parallel planes, to virtually en-

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close the vanes. The bending of the side wall sections and of the vanes may take place concurrently, depending upon the equipment used in carrying out these manufacturing operations. Transverse section taken along the plan IX-IX and illustrated in Fig. 9 now illustrates the form of the strip and it will be noted that wall portions 14 and 15 have been formed, these wall portions being substantially planar, parallel and slightly spaced from the edges of the intervening, integral vanes. Thereafter, by a separate operation, the extension of the deeper side-wall section 15 is bent over as indicated at 15' and illustrated in Fig. 10. This completes the formation of a modular, metallic, diffusion strip. Strips such as 2 and 2' are made in identical fashion but the inclination of the vanes is opposed to that in strip 3.

Any desired number of these modular strips may then be placed in side-by-side relation so as to provide an outlet grid having both parallel, air-straightening walls (such as 14 and 15) and vanes which are inclined so as to provide suitable distribution, deflection and diffusion of the air. It will be noted from an examination of Fig. 3 that the four modular strips 2, 2', 3 and 3' are placed in interlocking relation, the vanes of adjacent strips being bent in opposed directions so as to diffuse the air in what is known as laminar counterflow. Each modular strip is interconnected to its adjacent strip by engagement of the bent-over section 15' with an adjacent shorter wall section of the adjacent modular strip. This entire assembly is placed within the frame 1; such frame generally includes an inwardly extending lip 8 upon which the nested, parallel, adjacent modular strips are supported and onto which they may be spot-welded. The outwardly extending flange of the frame 1 normally carries a strip of felt or other resilient material for sealing contact with marginal portions of a wall or other structure in which the opening is formed. In order to add symmetry to the appearance of the completed grille, a dummy, U-shaped element indicated at 9 is placed upon the upstanding, short wall of modular strip 2'.

The wall section of greater depth may be of sufficiently increased depth so as to provide an additional vane. This modification is illustrated in Fig. 11 wherein it will be noted that the wall section 15 is provided with an extension 35 of sufficient depth so as to actually permit overfolding and form a vane extending well beyond the longitudinal edge of wall 14 and which is now bent so as to lie in a plane at an angle to the wall sections 14 and 15 and also at an angle to the vanes 13, 23 and the like. Modular strip elements of the character illustrated in Fig. 11 have great possibilities in that they may be employed in making diffusion grilles which most effectively produce laminar counterflow and diffuse the air and direct it so as to produce fan-shaped, diffused supplies of air to a room or enclosure. The angulation of the added louvers such as 35 may be varied by simply bending the metal to a desired angle.

A further modification employing additional louvers is illustrated in Fig. 12. As there shown, the spaced wall sections 14 and 15 are of equal length, but the frontal longitudinal edge portions of these wall sections have been provided with semicircular, longitudinally extending, beaded terminals 36 and 37 so that when these modular strips are placed in side-by-side, parallel relation, and the adjacent, beaded portions, such as the bead 37 and the bead 36' of the adjacent portion are brought together, they form an interlocking connection which may receive a vane of louver 38 provided with a socket 39 incompletely encircling the bead and permitting the entire louver or vane 38 to be pivotally adjusted upon the cylindrical bead formed by the portions 37 and 36'. Vane elements such as 38 may be rolled from sheet metal or they may be extrusions of aluminum, plastic composition etc. The outer or frontal edges of beads 36 may be spaced to provide an opening of 100° to 140°

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and the vane may have a substantially cylindrical edge embraced by such beads and partially pivotable therein.

The side-wall sections of each of the strip elements need not be exactly parallel, and instead, may be bent to lie in spaced, slightly diverging planes, with the frontal edge portions slightly further apart than the rear edge portions. This arrangement increases the flexibility of the strip elements in that a great variety of openings, differing in width, may be filled by the use of modular strip elements of equal width. For example, if the external width of a strip element, with wall sections parallel, is exactly one inch, then the width of the frame or opening in which such elements are used must be a multiple of one inch and although openings of four inches, six inches, eight inches, sixteen inches, etc. may be readily fitted, difficulty would be encountered with an opening eight and one-half inches in width. If, however, the flared, side-wall construction is used, which is illustrated in Figs. 13 and 14, so that the upper or frontal longitudinal edges are, say, one and one-sixteenth inches apart, and the external width at the rear edges is fifteen-sixteenths inch, then the resiliency of the side-wall sections would permit eight such strips to be used in an opening seven and one-half inches wide, eight inches wide, or eight and one-half inches wide.

It will be noted, by referring to Fig. 13, for example, that the wall sections 44 and 45 of one modular strip diverge outwardly from the rear longitudinal edges of such wall sections and are spaced further apart at the frontal edges of such wall sections. In the particular form illustrated in Fig. 13, the frontal edges of these wall sections are provided with inwardly directed lips 46 and 47, respectively. The two adjacent strips illustrated in Fig. 13 are identical but the vanes 49 are inclined in one direction and the vanes 49' of the other strip are inclined in the opposite direction, this position being attained by simply reversing the direction of the strip end for end. When the two strips are then placed in substantial side-by-side relationship, the wall 45 and the wall 45' will contact at upper edges and an interlocking, decorative strip 50 may be longitudinally slid along such abutting edges so as to grasp the oppositely directed flanges 47 and 47'. It will be readily understood that such adjacent strips may be compressed one against the other so as to fit into a somewhat smaller space than that established by the contact of the outer or frontal edges of the strips, the maximum compression thus laterally possible being established by the bottom width of the strips.

In Fig. 14 a further modification is illustrated wherein one of the diverging wall sections, such as 55, is provided with an outer, rolled portion 57 adapted to engage the longitudinal, frontal edge of the wall section 58 of the adjacent strip. Again the vanes 56 on one strip are inclined in one direction whereas the vanes 56' of the adjacent strip are inclined in an opposite direction. The flexibility above noted is also attained by this construction. It is not always necessary or desirable to have the vanes of adjacent strips inclined in opposite directions, and by suitable changes in contours of the wall sections or by the use of two or three adjacent strips of the same kind, a grille may be caused to discharge air in one direction only.

Those skilled in the art, after contemplating the disclosures made herein, will readily appreciate that various other ways of nesting or connecting the modular strips could be used without departing from the concepts embodied herein. All changes and modifications coming within the scope of the claims are embraced by this invention.

I claim:

1. A directional, diffusing outlet grid assembly for heating, ventilating and conditioning systems, said assembly being adapted for installation across a supply opening in a plane normal to the axial flow of air there-

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from and including directional elements both parallel and inclined to such axial flow, comprising: a series of metallic strips in parallel, substantially side-by-side relation, each of said strips comprising a pair of virtually parallel, longitudinally extending, spaced wall sections and a plurality of vanes virtually wholly contained and positioned between said wall sections and lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of wall sections and intervening vanes being integral; and an interlocking connection means between a wall section of one of said strips and a wall section of an adjacent strip.

2. A directional, diffusing outlet grid assembly as stated in claim 1, said interlocking connection means including an adjustable secondary vane element movable into planes at an angle to the plane of the wall sections and to the plane of said vanes.

3. A directional, diffusing outlet grid assembly for heating, ventilating and conditioning systems, said assembly being adapted for installation across a supply opening in a plane normal to the axial flow of air therefrom and including directional elements both parallel and inclined to such axial flow, comprising: a series of metallic strips in parallel, substantially side-by-side relation, each of said strips being formed to comprise a pair of virtually parallel, longitudinally extending, spaced wall sections, each provided with a front, longitudinally extending edge, and a plurality of vanes positioned between said wall sections lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of wall sections and intervening vanes being integral, one of said wall sections being of greater depth than the other wall section, the longitudinally extending front edge portion of said wall section of greater depth being folded over to interlock with the wall section of an adjacent strip.

4. A diffusing outlet grid assembly of the character stated in claim 3, wherein the wall section of greater depth is folded over in a zone materially in advance of the front, longitudinally extending edge of the wall section of shorter depth, said folded-over portion forming a bendable louvre adapted to lie in a plane at an angle to the plane of the vanes and at an angle to the plane of the wall section of shorter depth.

5. A directional, diffusing outlet grid assembly for heating, ventilating and conditioning systems, said assembly being adapted for installation across a supply opening in a plane normal to the axial flow of air therefrom and including directional elements both parallel and inclined to such axial flow, comprising: a series of metallic strips in parallel, substantially side-by-side relation, each of said strips comprising a pair of virtually parallel, longitudinally extending, spaced wall sections and a plurality of vanes virtually wholly contained and positioned between said wall sections and lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of wall sections and intervening vanes being integral; and means connecting said preformed strips in side-by-side relation with the vanes of at least some of said strips inclined in a direction opposed to the direction of inclination of vanes in adjacent strips.

6. A directional, diffusing outlet grid assembly for heating, ventilating and conditioning systems, said assembly being adapted for installation across a supply opening in a plane normal to the axial flow of air therefrom and including directional elements both parallel and inclined to such axial flow, comprising: a series of metallic strips in parallel, substantially side-by-side relation, each of said strips being preformed to comprise a pair of virtually parallel, longitudinally extending, spaced wall sections and a plurality of vanes virtually wholly contained and positioned between said wall sections and lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of

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wall sections and intervening vanes being integral; each of said wall sections being provided with a longitudinally extending edge portion provided with a deformation extending out of the plane of said wall section; and a connecting means engaging deformations in the edge portions of wall sections of adjacent strips.

7. A diffusing outlet grid as stated in claim 6, wherein said connecting means comprises a vane adjustably positionable into planes at an angle to the plane of said wall sections and the planes of said vanes.

8. A unitary modular strip element for use in directional, diffusing outlet grid assemblies composed of a plurality of said elements in parallel, virtually side-by-side relation, said assembly being adapted for installation across an air supply opening, comprising: a pair of virtually parallel, longitudinally extending, spaced wall sections and a plurality of vanes positioned and virtually wholly contained between said wall sections and lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of wall sections and intervening vanes being integral and formed from a single strip of sheet metal, said strip elements being positionable with a wall section of one strip in substantial contact with a wall section of an adjacent strip.

9. A unitary modular strip element for use in directional, diffusing outlet grid assemblies composed of a plurality of said elements in parallel, virtually side-by-side relation, said assembly being adapted for installation across an air supply opening, comprising: a pair of virtually parallel, longitudinally extending, spaced wall sections and a plurality of vanes positioned and virtually wholly contained between said wall sections and lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of wall sections and intervening vanes being integral; each of said wall sections being provided with an integral longitudinally extending edge portion provided with a deformation extending out of the plane of said wall section.

10. A unitary modular strip element for use in directional, diffusing outlet grid assemblies composed of a

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plurality of said elements in parallel, virtually side-by-side relation, said assembly being adapted for installation across an air supply opening, comprising: a pair of longitudinally extending wall sections, each provided with a longitudinal frontal edge portion and a rear edge portion, said frontal and rear edge portions being parallel, said frontal edge portions being spaced apart a slightly greater distance than said rear edge portions whereby said wall sections lie in slightly diverging planes, and a plurality of vanes positioned between said wall sections and lying in planes transverse to said wall sections and inclined to the longitudinal axis of said strip, said pair of wall sections and intervening vanes being integral.

11. A unitary strip element as stated in claim 10 wherein the frontal edge portion of at least one of said wall sections is provided with means for connecting said strip to the frontal edge portion of an adjacent strip.

12. A unitary strip element as stated in claim 10 wherein the frontal edge portions of said wall sections are each provided with a deformation extending out of the plane of the wall section, the deformations of adjacent wall sections of adjacent strips being adapted to cooperatively engage a connecting means.

13. A unitary strip element as stated in claim 12 wherein the connecting means includes a planar vane angularly adjustable into planes at an angle to the plane of said wall sections and said intervening vanes.

14. A unitary strip element as stated in claim 10 wherein one of said wall sections is of greater depth than the other, the frontal edge portion of said wall section of greater depth being folded over outwardly and rearwardly.

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