

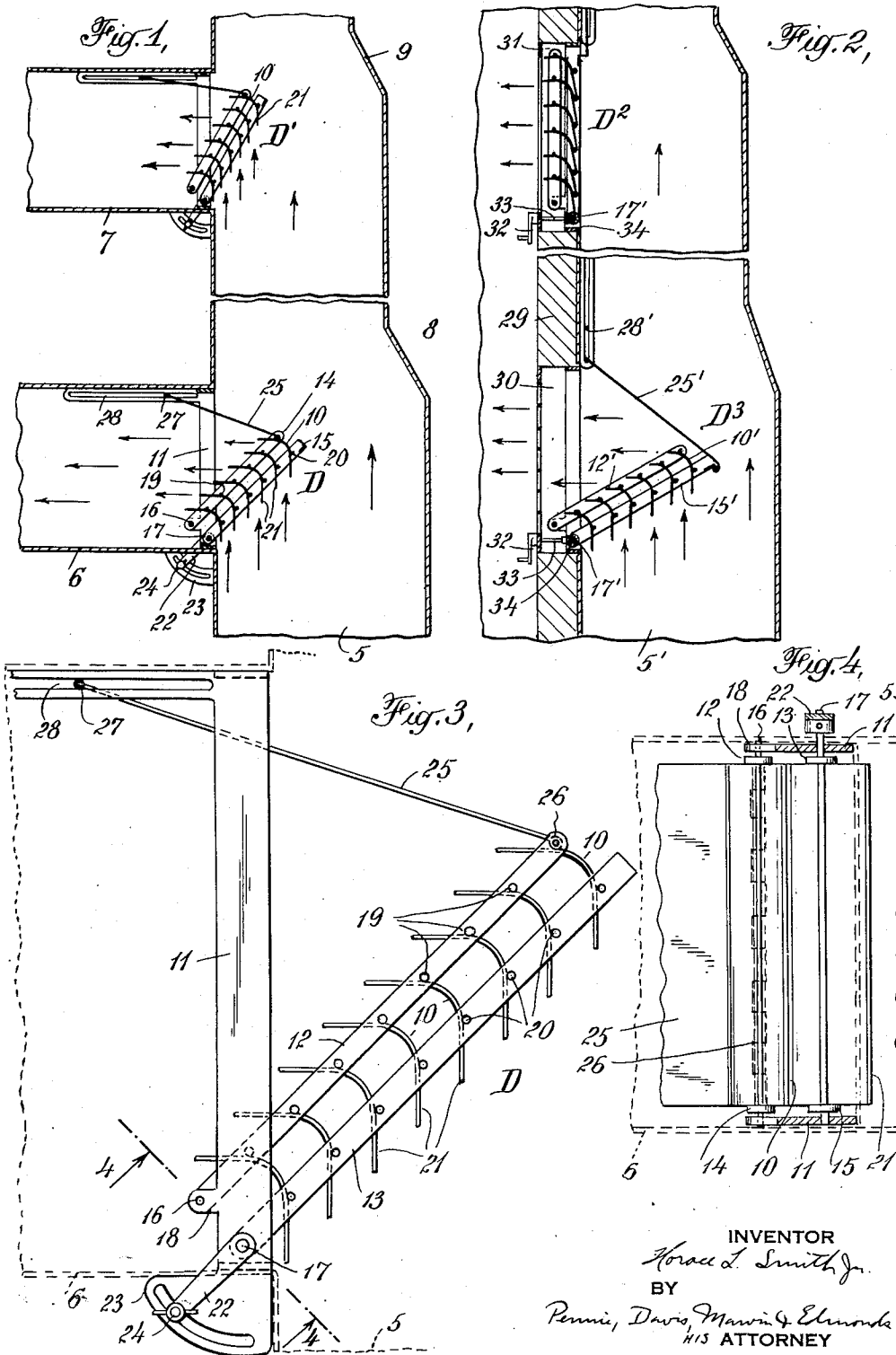
May 21, 1935.

H. L. SMITH, JR

2,001,801

AIR DISTRIBUTION

Filed Sept. 17, 1934



INVENTOR

Horace L. Smith, Jr.

BY

Pennie, Davis, Mawin & Edwards
HIS ATTORNEY

UNITED STATES PATENT OFFICE

2,001,801

AIR DISTRIBUTION

Horace L. Smith, Jr., Richmond, Va., assignor to
Thermal Engineering Corporation, Richmond,
Va., a corporation of Virginia

Application September 17, 1934, Serial No. 744,302

13 Claims. (Cl. 98—106)

This invention relates to air distribution and more particularly concerns improvements in distributing air through ducts for cooling, heating or air conditioning buildings or other structures.

5 In constructing ducts and outlets for conducting conditioned air from a central source to a plurality of building rooms or other points of consumption, it is essential that the elbows, junctions and outlets of the ducts be designed to prevent noise and to reduce velocity pressure losses to a minimum. A serious source of noise and velocity pressure loss in duct systems is the turbulent air action which occurs at points of juncture between main supply air ducts and the branches or room outlets therefrom, substantially all of which outlets lie at a considerable angle to the supply duct. It has been customary to reduce this air turbulence at junctions by connecting the branch duct or outlet to the main duct through a curved junction member of considerable radius and by extending the inlet end of the junction to a point within the supply duct in substantial alignment with the flow path of the air therein. These large radius curved junctions not only occupy considerable space and interfere with the usual rectangular arrangement of building walls, floors and ceilings, but the cost of such junctions is excessive since the fabrication of curved duct sections from sheet metal or other suitable material is a laborious procedure requiring the services of skilled artisans.

With the above and other considerations in mind, it is proposed in accordance with the present invention to provide an improved device in the nature of a deflector damper for deflecting adjustable amounts of air from a supply duct to a branch duct or outlet connected at an angle to the supply duct without substantial loss of velocity pressure and without substantial air turbulence. Other objects of the invention include the provision of a deflector damper device of the type described which may be adjusted to completely cut off the flow of air to the branch duct or outlet as well as to variably adjust this air flow to the desired volume, all without substantial loss of velocity pressure in the supply duct, the branch duct or outlet or in the junction between these passages.

In general, the above and other objects of my invention are carried out by providing a plurality of vanes or air splitters which are disposed in parallel relationship and have at least a portion thereof set at an angle to the axes of both the supply duct and the branch duct or outlet. These vanes are supported by means which are prefer-

ably pivoted adjacent one end of the branch duct or outlet in such a manner that the assembly of vanes extends into and partially across the stream of air in the supply duct and the vanes deflect the desired amount of air from the supply duct to the branch duct or outlet. The vanes are preferably curved in such a manner that one side edge of each vane is substantially aligned with or tangent to the flow path of the air in the supply duct, while the other edge thereof is substantially aligned with or tangent to the desired flow path of air in the branch duct or outlet. In other words, each edge of each vane is disposed in alignment with or tangent to a plane parallel to the axis of one of the ducts. With this arrangement, air from the supply ducts is diverted into the branch duct or outlet without substantial loss of pressure, even if the branch duct or outlet joins the supply duct at right angles, and the use of curved junction duct members is entirely avoided.

The supporting means for the vanes is preferably so constructed that the series of vanes may be moved parallel to each other and to their original positions so that the opposite edges of each vane are maintained in substantial alignment respectively with the supply and branch ducts in every adjusted position of the deflector damper device. This parallel motion of the vanes is preferably effected by providing two parallel supporting elements, pivoted at spaced points adjacent one edge of the branch duct or outlet opening, and by pivotally connecting spaced points on each vane to the respective supporting elements. Suitable means such as a movable plate is preferably provided to close the space between the free end of the deflector damper device and the edge of the branch duct or outlet opening opposite that at which the device is pivoted.

The inner edges of the vanes which lie tangent to the flow path of the air in the supply duct are preferably elongated to such an extent that they engage the surfaces of the adjacent vanes when the deflector damper device is swung across the entrance of the supply duct or outlet, and the device thus acts as a cut-off damper in addition to its flow regulating and velocity pressure loss preventing functions.

The invention will be best understood by reference to the accompanying drawing in which a typical embodiment thereof has been illustrated. In the drawing:

Figure 1 is a sectional plan view of two deflector damper devices embodying my invention and combined with air duct junctions;

Figure 2 is a sectional plan view similar to Figure 1 showing the combination of my deflector damper device with outlets from an air supply duct;

5 Figure 3 is an enlarged plan view of a deflector damper device embodying my invention; and

Figure 4 is a sectional view taken along the line 4-4 of Figure 3 and viewed in the direction of the arrows.

10 Referring to the drawing, and particularly to Figure 1, the deflector damper device of my invention has been shown in combination with a main or feeder air supply duct 5 and two branch ducts 6 and 7 connected thereto. In accordance
15 with usual practice, the ducts 5, 6 and 7 are of substantially rectangular section. In the illustrated embodiment, the branch ducts 6 and 7 join the supply duct 5 at right angles since right angle junctions are usually necessitated by conventional building construction but it should, of course, be understood that my invention is applicable to junctions of any desired angularity. Heated, cooled or conditioned air from any suitable source is propelled through the supply duct 5
20 in the direction indicated by the arrows. In accordance with usual practice, the supply duct 5 is reduced in section beyond each branch duct junction, as shown at 8 and 9.

In accordance with my invention, an improved
30 deflector damper device D, D' is located at the entrance of each of the branch ducts 6 and 7, and since in the illustrated embodiments, these devices are of substantially identical construction, only one thereof will be described in detail and the corresponding parts of the other deflector damper devices will be designated with like reference characters having distinctive exponents.

Referring to the deflector damper device proper
40 which is shown in detail in Figs. 3 and 4, this device comprises generally a series of elongated spaced vanes or air splitters 10 disposed in parallel relationship and having at least a portion thereof disposed at an angle to the axes of both
45 the supply duct and the branch duct or other outlet. I prefer to employ vanes of uniformly curved section, and vanes 10 of this type have been shown in the drawing. The curvature of each of the vanes 10 is such that one longitudinal edge thereof is substantially aligned with or tangent to a plane parallel to the axis of the supply duct while the other longitudinal edge thereof is substantially aligned with or tangent to a plane parallel to the axis of the branch or outlet
50 as shown in Figs. 1, 2 and 3.

Suitable parallel motion supporting means is preferably provided for carrying the vanes 10 and moving them to their various adjusted positions. As shown in the drawing, a rectangular frame
60 11 is fixed in the entrance of the branch duct 6 and two pairs of parallel spaced supporting elements or arms 12, 13 and 14, 15 are respectively pivotally supported on opposite surfaces of the frame 11 adjacent one end thereof by the rods
65 16 and 17. The parallel arms 12 and 13 are disposed adjacent the upper surface of the ducts 5 and 6 and the arms 14 and 15 are disposed adjacent the lower surface thereof, as shown in Fig. 4, and the arms 13 and 15 are vertically aligned and fixed respectively to the pivot rod 17 so that these arms move in vertical alignment when the rod 17 is turned. The pivot rods 16 and 17 are spaced apart as shown along a plane disposed at an angle to the axis of both of the connected
70 ducts 5 and 6, the rod 16 being preferably car-

ried by lugs 18 on the frame 11. The arms 12 and 14 are vertically connected by a plurality of equally spaced vertical vane pivot rods 19 which are journaled in the arms, and the arms 13 and 15 are similarly connected by a series of equally
5 spaced similarly journaled vertical vane pivot rods 20. Spaced points on each of the vanes 10 are respectively soldered or otherwise suitably secured to the rods 19 and 20 so that each vane extends between a pair of parallel adjacent rods
10 on the two sets of arms. The sets of arms 12, 13 and 14, 15 are disposed in parallel relationship. With this arrangement, the pivotal movement of the arms 12, 13, 14 and 15 about the rods 16 and 17 moves the series of vanes 10 out into 15 and at least partially across the supply duct 5, the vanes being maintained in parallel relationship during such movement. At every position of the deflector damper device, the opposite longitudinal edges of the vanes 10 are respectively
20 maintained substantially tangent to the axial flow paths of the supply and branch ducts.

The inner edge of each of the vanes 10 preferably terminates in an elongated plane portion
25 21 of sufficient length to engage the surface of the adjacent vane when the deflector damper device is closed across the branch duct or outlet as shown in Fig. 2. Thus the vanes 10 act to cut off the flow of air to the branch duct or outlet when the deflector damper device is withdrawn
30 from the air stream of the supply duct.

Any suitable means may be provided for variably adjusting the position of the deflector damper device and thereby controlling the amount of air diverted from the supply duct 5. As shown
35 in Figures 1, 3 and 4, this adjustment may be conveniently accomplished by extending the pivot rod 17 through the duct wall and providing a handle 22 on this rod outside of the duct. A slotted quadrant 23 may be suitably fixed adjacent the
40 outer end of the handle 22 and a bolt and wing nut 24 provided for clamping the handle 22 to the quadrant 23 in any desired adjusted position.

Although not essential to all embodiments of the invention, it is preferred in most cases to provide means for closing the space between the free end of the deflector damper device which extends into the supply duct and the side of the branch duct or outlet opposite that at which the
45 deflector damper device is pivoted, thereby confining the air stream deflected by the vanes 10 to the branch duct. As shown in the drawing, this closure member preferably comprises a plate 25, one end of which is pivotally secured to the outermost vane pivot rod 19 carried by the arms
50 12 and 14. The plate 25 and the outermost vane 10 are preferably connected together and to the vane pivot rod 19 by a piano hinge construction as shown at 26 in Fig. 4. The opposite or outer edge of the plate 25 is secured in any suitable
60 manner to move along the wall of the branch duct 6 or the supply duct 5. As shown in Figs. 1 and 2, a vertical rod 27 is secured to the outer end edge of the plate 25 and extends beyond the top and bottom edges thereof into slots 28 formed
65 in extensions of the frame 11. With this arrangement, the plate 25 closes the space between the free inner end of the deflector damper device and the wall of the branch duct 6 regardless of the position of the deflector damper device.

My improved deflector damper device is obviously applicable to all types of duct junctions and to direct air outlets from supply ducts as well. As shown in Fig. 2, a supply duct 5' is frequently
70 disposed just inside a room wall 29 and outlet 75

openings 30 and 31 are provided through this wa between the supply duct 5' and the interior of the room. It is essential to proper air distribution and saving of velocity pressure that the air be delivered through the openings 30 and 31 in a direction normal to the room wall 29, and by employing my improved deflector damper device as shown at D³ and D⁴ in each outlet opening, this is readily accomplished. Due to the limited depth of the outlet openings 30 and 31, the outer end edges of the closure plates 25 are supported in guide slots 28' which extend along the wall of the supply duct 5' as is clearly shown in the lower half of Fig. 2. The deflector damper devices D² and D³ of the direct outlet construction shown in Fig. 2 may be variably adjusted by cranks 32 connected to the pivot rods 17' through shafts 33 and bevel gears 34.

It will be clearly apparent that my improved deflector damper device operates in the same manner whether used in combination with junctions between a supply duct and a branch duct or with junctions between a supply duct and a direct room outlet, acting in either case to deflect adjustable quantities of air out of the supply duct without substantial loss in velocity pressure and without the provision of any curved duct construction whatever. In the appended claims, the term branch duct has been employed in the generic sense to designate both extended ducts connected to a supply duct and direct room outlets from a supply duct.

I claim:

1. The combination with an air supply duct and a branch duct connected at an angle thereto, of a deflector damper device for controlling the flow of air from said supply duct to said branch duct comprising a plurality of elongated spaced vanes disposed lengthwise transversely of said ducts and in parallel relationship at an angle to the axes of both of said ducts, supporting means for said vanes pivoted at one edge of said branch duct, pivotal connections between each of said vanes and said supporting means, means for moving said supporting means to adjusted positions in and at least partially across said air supply duct and means acting upon movement of said supporting means about its pivot and as the result of said movement to turn said vanes continuously with respect to said supporting means to maintain the transverse directions of said vanes parallel to their original positions at all adjusted positions of said supporting means.

2. The combination with an air supply duct and a branch duct connected at an angle thereto, of a deflector damper device for controlling the flow of air from said supply duct to said branch duct comprising a plurality of curved spaced parallel vanes, each of said vanes having one edge thereof substantially tangent to a plane parallel to the axis of said supply duct and having the other edge thereof substantially tangent to a plane parallel to the axis of said branch duct, and means for moving said vanes in parallel relationship and parallel to their original positions to adjusted positions extending from one edge of said branch duct into and at least partially across said supply duct whereby air from said supply duct is deflected into said branch duct.

3. The combination with an air supply duct and a branch duct connected at an angle thereto of means for deflecting air from said supply duct into said branch duct comprising a series of spaced parallel elongated vanes, each extending

lengthwise at least partially across said supply duct and each uniformly curved to such an extent that one side edge thereof is substantially tangent to a plane parallel to the axis of said supply duct and the other side edge thereof is substantially tangent to a plane parallel to the axis of said branch duct, said series of parallel vanes extending from one edge of the entrance of said branch duct out into and partially across said supply duct, and closure means extending from the other edge of said branch duct entrance to the end of said series of vanes which extend into and partially across said supply duct.

4. The combination with an air supply duct and a branch duct connected at an angle thereto of means for deflecting adjustable amounts of air from said supply duct to said branch duct comprising a series of spaced parallel elongated vanes, each extending lengthwise at least partially across said supply duct and each curved in section to such an extent that one side edge thereof is substantially tangent to a plane parallel to the axis of said supply duct and the other side edge thereof is substantially tangent to a plane parallel to the axis of said branch duct and parallel motion supporting means for moving said series of vanes in parallel spaced relation to adjusted positions extending from one edge of the entrance of said branch duct into and at least partially across said supply duct.

5. The combination with an air supply duct and a branch duct connected at an angle thereto of means for deflecting adjustable amounts of air from said supply duct to said branch duct comprising a series of spaced parallel elongated vanes, each extending lengthwise at least partially across said supply duct and each curved in section to such an extent that one side edge thereof is substantially tangent to a plane parallel to the axis of said supply duct and the other side edge thereof is substantially tangent to a plane parallel to the axis of said branch duct, a pair of spaced parallel supporting elements respectively pivoted at spaced points adjacent one edge of said branch duct at its point of juncture with said supply duct, means for pivotally connecting points spaced transversely of each of said vanes to said respective supporting elements whereby upon pivotal movement of said supporting elements said series of vanes is moved in parallel relationship into and partially across said duct, and a plate movably connected between the free end of said series of vanes and the wall of said branch duct opposite the edge thereof at which said supporting elements are pivoted.

6. A deflector damper device of the type described comprising a pair of spaced elongated supporting elements disposed in parallel relationship, parallel spaced pivots respectively supporting adjacent ends of said elements, a plurality of air deflecting vanes disposed in parallel relationship at spaced points along said elements, and means for pivotally connecting to said respective supporting elements, points on each of said vanes which are spaced by an amount equal to the spacing of said pivotal supports of said supporting elements, said pivotal connections to each vane being respectively equally spaced from the pivotal supports of said respective supporting elements whereby upon pivotal movement of said supporting elements all of said vanes are continuously moved with respect to said supporting elements as the result of said pivotal movement of said supporting elements to maintain the

transverse directions of said vanes parallel to their original positions.

7. The combination with an air supply duct and a branch duct connected at an angle thereto, of a deflector damper device for controlling the flow of air between said ducts comprising a pivoted support and at least one elongated vane disposed lengthwise transversely of said ducts and at an angle to the axes of both of said ducts and pivoted to said pivoted support, and means pivotally connected to both said vane and a fixed support, whereby movement of the pivoted support about its pivot will result in said vane being turned continuously with respect to said pivoted support and so that its transverse directions are at all times parallel to its original position and from a position across said branch duct to adjusted positions in and at least partially across said supply duct.

8. The combination with an air supply duct and a branch duct connected at an angle thereto, of a deflector damper device for controlling the flow of air from said supply duct to said branch duct comprising at least one elongated vane of curved section having one edge thereof substantially tangent to a plane parallel to the axis of said supply duct and having its other edge substantially tangent to a plane parallel to the axis of said branch duct, and means for moving said vane parallel to its original position to adjusted locations opposite the entrance to said branch duct and at least partially across said supply duct whereby air from said supply duct is deflected by said vane into said branch duct.

9. A deflector damper device of the type described comprising a pair of spaced elongated supporting elements disposed in parallel relationship, parallel spaced pivots respectively supporting adjacent ends of said elements, and at least one air deflecting vane having spaced points thereon pivotally connected to said respective supporting elements at points equally spaced from the pivotal supports of said respective supporting elements whereby upon pivotal movement of said supporting elements said vane is turned continuously with respect to said supporting elements as a result of the turning of the supporting elements about their pivots to maintain the transverse directions of said vane parallel to its original position at all adjusted positions of the supporting elements.

10. A deflector damper device of the type described comprising a pair of spaced parallel elongated supporting elements, parallel spaced pivots respectively supporting the adjacent ends of said elements, at least one curved elongated vane extending substantially at right angles to said elements and means for pivotally connecting spaced points on said vane to points on said respective supporting elements which are equally spaced from the pivotal supports of said respective supporting elements whereby upon pivotal movement of said supporting elements, said vane is turned

continuously with respect to said supporting elements as a result of the turning of the supporting elements about their pivots to maintain the transverse directions of said vane parallel to its original position at all adjusted positions of the supporting elements.

11. The combination with an air supply duct and a branch duct connected at an angle thereto of means for controlling the flow of air from said supply duct into said branch duct comprising a series of spaced parallel elongated vanes, each extending lengthwise across said supply duct and each uniformly curved in section to such an extent that one side edge thereof is in substantial alignment with a plane parallel to the axis of said supply duct and the other side edge thereof is substantially tangent to a plane parallel to the axis of said branch duct, parallel motion supporting means for moving said series of vanes in parallel spaced relation to adjusted positions extending from one edge of the entrance of said branch duct into and at least partially across said supply duct, said edges of said vanes which are in substantial alignment with a plane parallel to the axis of said supply duct being of sufficient extent to engage the adjacent vanes when said series of vanes is moved by said parallel motion supporting means across the entrance to said branch duct, and means outside the ducts for variably adjusting the position of said parallel motion supporting means.

12. The combination with an air supply duct and a branch duct connected at substantially right angles thereto, of means for controllably diverting air from said supply duct into said branch duct comprising a pair of spaced parallel pivot rods extending vertically across the entrance of said branch duct adjacent one side thereof, a pair of vertically aligned supporting arms respectively secured to each of said pivots adjacent the ends thereof, a plurality of parallel elongated air deflecting vanes of curved section extending vertically between said pairs of vertically aligned supporting arms, each of said vanes having its longitudinal edges in substantial alignment respectively with said supply and branch ducts, and means for pivotally connecting transversely spaced points on each of said vanes to said respective pairs of supporting arms.

13. An adjustable deflector damper device comprising a substantially rectangular frame, a pair of spaced parallel pivots extending vertically across said frame adjacent one side thereof, a pair of aligned supporting arms respectively secured to each of said pivots adjacent the ends thereof, a plurality of elongated air deflecting vanes of curved section extending vertically and in parallel relation between said pairs of aligned supporting arms and means for pivotally connecting transversely spaced points on each of said vanes to said respective pairs of supporting arms.

HORACE L. SMITH, JR.