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AIR MIXER FOR AIR STREAMS

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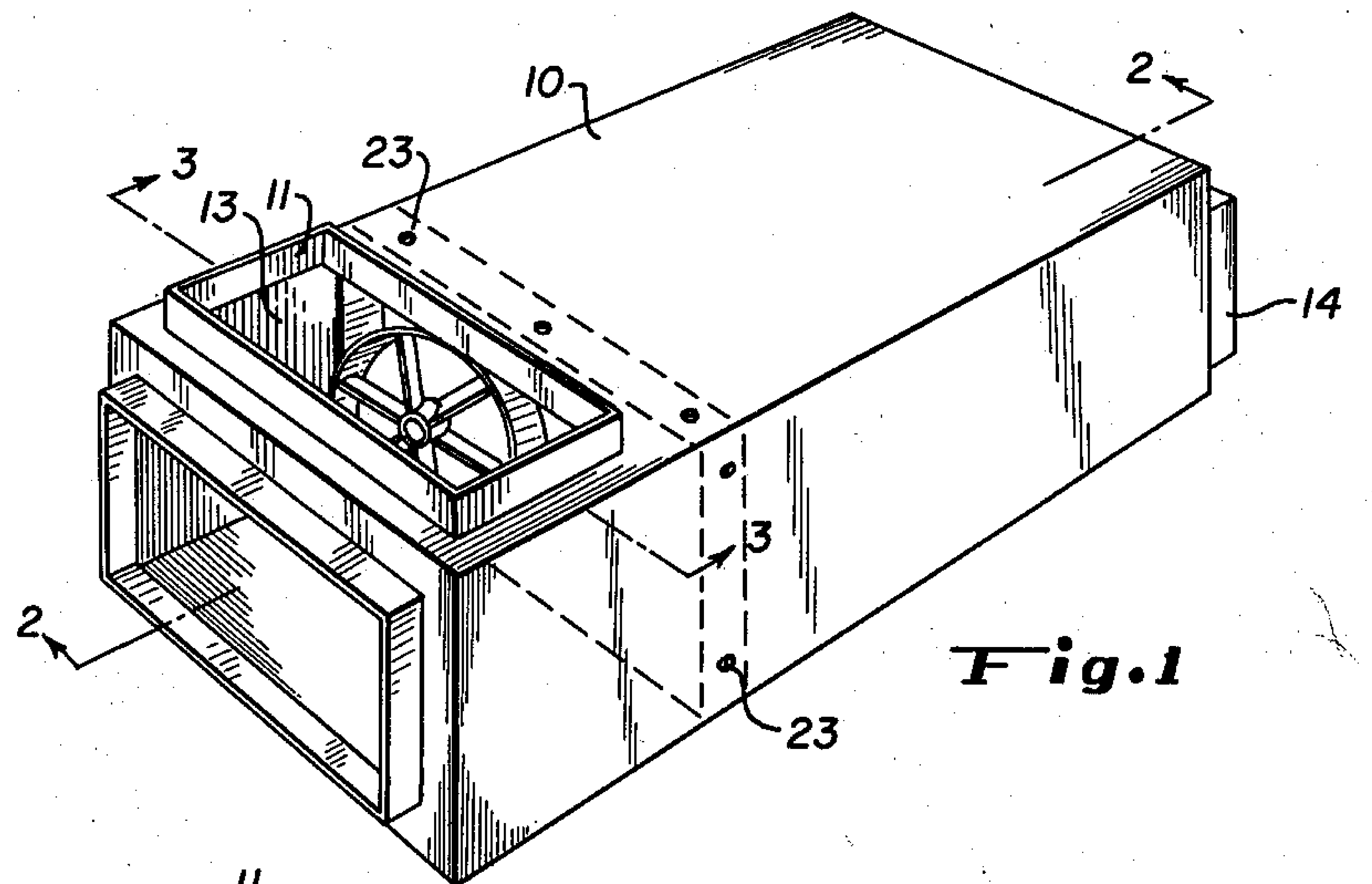

Fig. 1

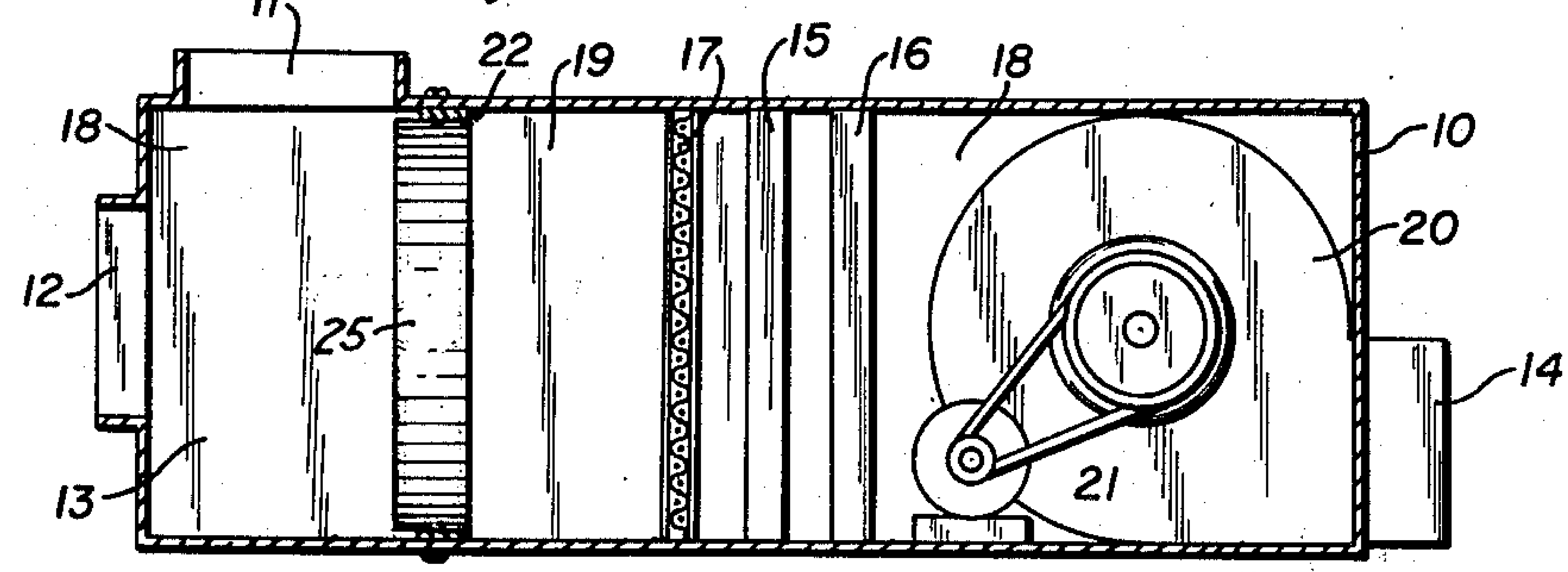

Fig. 2

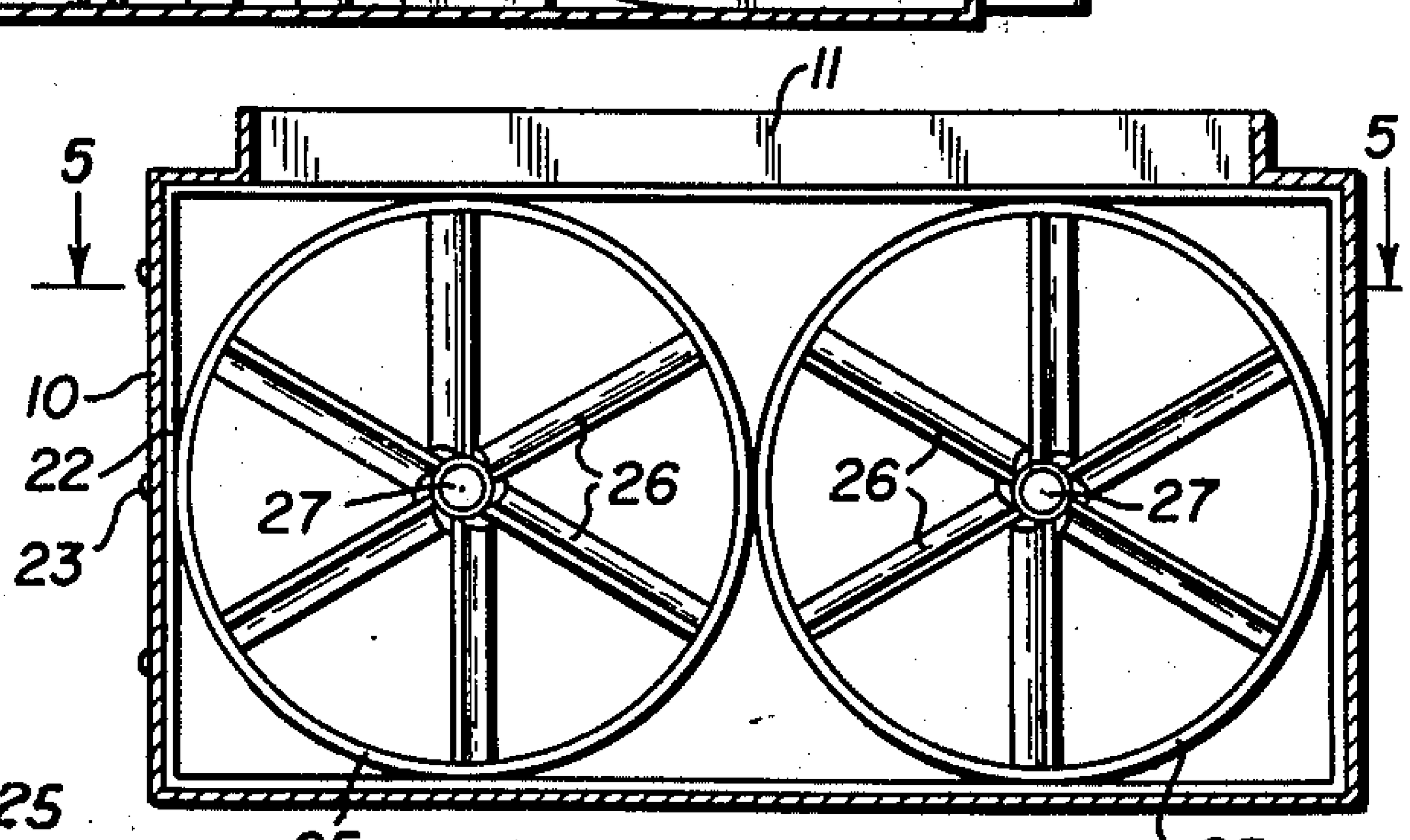

Fig. 3

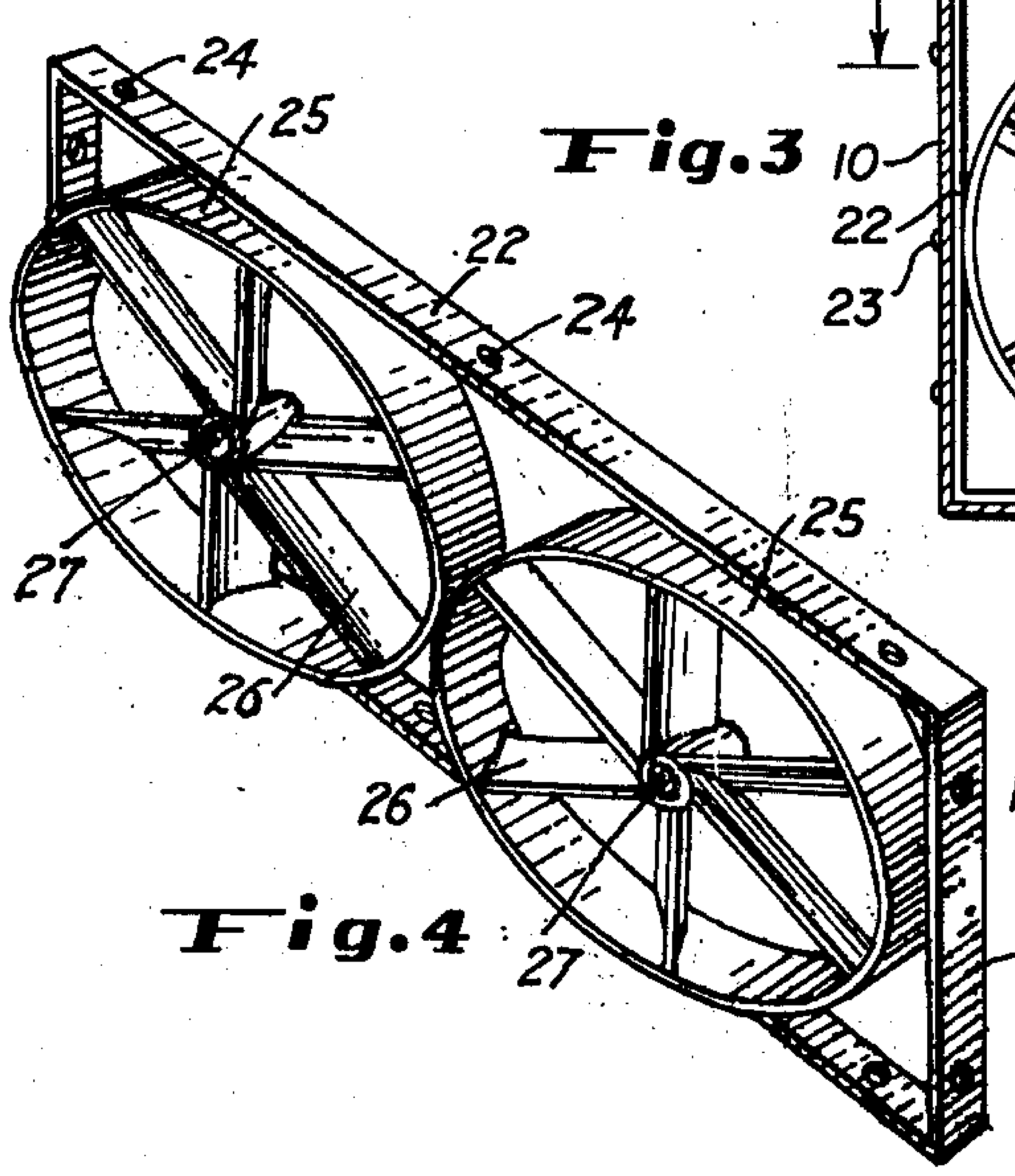

Fig. 4

Fig. 5

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AIR MIXER FOR AIR STREAMS

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This invention relates to air conditioning systems as employed in buildings for ventilating and maintaining uniform temperature conditions by the distribution of air of controlled temperature throughout the building. Such systems are controllable to intake air from either or both the interior and exterior of the building and are thermostatically controlled to heat or cool the intaken air so as to maintain a preselected uniform temperature in the building.

One problem with such systems arises from the difficulty in obtaining an intimate mixture of the outside and inside air throughout the system but more particularly before it enters the heating and cooling devices.

In such systems there is a tendency to temperature stratification in the air streams. Ofter cold outside air will fail to completely mix with the warm indrawn inside air. The result will be a stratified air stream having a layer or layers of warm air and a layer or layers of cold air, which, due to their varying specific gravities are slow to intermix.

As a result a traveling layer or layers of below freezing air may flow through the stream or water coils of the conditioner so to actually freeze the water therein at various points. This causes a wide range of temperature variations across the cross section of the main air stream so that the air delivered by the distributing ducts to individual rooms may vary greatly in temperature.

Occasionally the stratification will be such that warm air will be delivered to rooms one side of a main duct and cold air to rooms on the other side thereof although all air is coming from the same air stream. The opposite will also be occasionally true should the outside temperature be higher than the desired interior temperature.

To overcome the above objections exceedingly expensive and complicated thermostatically-controlled individual room dampering devices have been attempted. This greatly increases the cost of installation and servicing and has not been uniformly satisfactory. It has also been attempted to obtain a mixture of indoor-outdoor air through the medium of relatively large baffle boxes but the results have been unsatisfactory and the space requirements are too great for the average building.

The principal object of this invention is to provide an air chamber for air conditioning systems which will intimately intermix two) or more incoming air streams of differing temperature, filter and temporize the intermixed streams and deliver the intermixed air to the system in a main stream having a uniform temperature throughout its entire cross section.

Another object of the invention is to provide a non-power-driven air mixing device which will occupy but a minimum of space and which can be economically installed in present systems and which will impart a plurality of oppositely rotating cyclonic whirls to an air stream so as to intimately intermix the air and prevent thermal stratification therein and to provide an air mixing device which will neither obstruct nor interfere with or restrict the volume or velocity of the air flow.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

FIG. 1 is a perspective view of an air mixing and conditioning chamber for an air conditioning system in which this invention is embodied;

FIG. 2 is a longitudinal sectional view taken on the line 2—2, FIG. 1;

FIG. 3 is a cross-sectional view taken on the line 3—3, FIG. 1; and

FIG. 4 is a perspective view of an improved air mixing assembly as used in the chamber of FIG. 1; and

FIG. 5 is a horizontal section through the assembly of FIG. 4, looking downwardly on the line 5—5, FIG. 4.

The invention employs a preferably rectangular mixing and conditioning chamber **10**, the size of which depends, of course, upon the volume of air to be conditioned. The chamber is provided with air inlets **11** and **12** at one of its extremities, opening to an entrance compartment **13**, and with a conditioned air outlet **14** at its other extremity. As illustrated, one of the inlets opens through the top of the compartment **13** and the other through the end thereof. For the purpose of description the one opening through the top will be designated as the inside air inlet **11** and the one opening through the end will be designated as the outside air inlet **12**. However, in actual practice, either could be connected to the inside air ducts of the system and either to the outside air ducts thereof. It is only essential that both open to the extremity of the chamber **10** opposite the conditioned air outlet **14**.

A heating radiator or coil **15**, a cooling radiator or coil **16** and a filter pad **17** extend transversally of the chamber **10** adjacent its middle dividing the latter into a fan compartment **18** and a mixing compartment **19**.

The fan compartment **18** contains one or more fans or exhaust blowers **20** driven by a suitable fan motor **21**. The blowers **20** intake from the fan compartment **18** and draw air through the intakes **11** and **12**, the filter pad **17**, the cooling coil **16**, and the heating coil **15** and discharge it from the outlet **14** for distribution through the system.

In conventional systems the two air streams entering the entrance compartment **13** are supposed to intermix therein before entering the filter. This is not true in actual practise. For instance, if cold air is entering at **12** and warm air at **11** they will stratify in the mixing compartment and the cold bottom layer of air will occasionally, if sufficiently cold, freeze the heating and cooling coils and create an unequal temperature distribution at the outlet **14**.

To avoid the above objections a mixing frame **22** is mounted transversally of the mixing compartment **19** separating the entrance compartment **13** from the mixing compartment **19**. The frame may be mounted therein in any desired manner such as by means of rivets or screws **23** entering receiving holes **24** in the frame **22**. A plurality of cylindrical bands or rings **25** are mounted in the mixing frame **22** in the plane of the latter in a suitable manner. As illustrated, there are two of the rings **25** mounted in the frame **22** and attached to the latter and to each other as by riveting or welding. In larger installations four or more of the cylinder rings **25** would be contained within the mixing frame **22**.

A plurality of laterally curved, radially-positioned turbine blades **26** are fixedly mounted in each of the rings **25** and extend radially inward to a fixed mounting on a hollow, barrel-shaped hub member **27**.

The blades **26** are formed from straight, elongated metal plates having a transverse curvature and are mounted in the rings **25** and on the hub members **27** so that their trailing edges will be positioned circumferentially in advance of their leading edges. Thus, the blades are transversally inclined or spirally pitched relative to the axis of an air stream passing through the surrounding ring **25** so as to impart a circumferential whirl to the traveling stream. The blades in adjacent rings are oppositely pitched or inclined, as shown in FIG. 5, so that the adjacent circumferential whirls will rotate in opposite directions and the adjacent sides of the whirls will move in the same direction.

As illustrated, and when viewed from the entrance chamber **13**, the blades of the left hand ring **25** are inclined to impart a counter-clockwise rotation to its whirl while the blades **26** of the right hand ring are inclined to impart a clockwise rotation to the whirl.

The whirls above referred to are not only imparted to the air entering the mixing compartment **19** but it has been proven by smoke tests the whirls are initiated in the entrance compartment **13**. Thus, the air is whirling in oppositely rotating whirls before it enters the mixing frame **22**.

Let us assume that cold air is entering at **12** and warm air at **11**. Normally the two streams of air of varying temperature would tend to stratify in the entrance compartment. However, with this invention in place the preliminary whirls in the entrance compartment and the comparatively violent and oppositely rotating whirls in the mixing compartment will cause the colder lower air to flow upwardly between the swirls to be replaced by warm air flowing downwardly at the sides of the swirls so that all tendency to stratify is destroyed and the air stream flows through the filter pad **17** at uniform temperature throughout the entire cross section of the chamber **10**.

As illustrated, the interstices between the rings **25** are open so that no resistance is imparted to the air flow. The air flowing through these open interstices will be caught up by and will join into the swirls imparted by the stationary turbine blades **26**. In some installations it may be economically advantageous to have a plate covering the entire area of the mixing frame with the rings **25** surrounding openings in the latter plate. This would increase the velocity of flow through the rings but would have a tendency to create resistance to flow. The final result, however, as to intermixing would be the same as above described.

The reason for the hollow barrel shape of the hub members is to facilitate manufacture. It can be seen that since the turbine blades have a curvated cross section they will fit more conveniently to and against a hub member having a convex surface upon which they are permanently mounted.

The number of rings and the diameters thereof depend of course upon the size of the installation. If the chamber **10** has a height of 3′-0″ and a width of 6′-0″ the rings **25** would have an approximate diameter of 3′-0″ with blades of an approximate length of 18″. For a chamber having a 12′-0″ square cross section four rings, each of an approximate diameter of 6′-0″ with blades of an approximate length of 3′-0″ would be employed. The blades in adjacent rings would be opposite in pitch as above described.

While a specific form of the invention has been described and illustrated herein, it is to be understood that the same may be varied within the scope of the appended claim, without departing from the spirit of the invention.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

An air chamber for intermixing streams of air of varying temperatures in an air conditioning system comprising: a substantially horizontal, hollow, elongated chamber of rectangular cross-section and of greater width than height; an entrance compartment opening to one end of said chamber; two independent inlets, opening to said entrance compartment for admitting two independent streams of air of differing temperatures to said compartment; an outlet compartment opening to the other end of said chamber; means for drawing air into said entrance compartment from said inlets and passing said air through said chamber into said outlet compartment; and means for intermixing said two streams of air, said intermixing means including: a hollow rectangular mixing frame mounted transversally of said chamber and dividing said inlet compartment from said chamber; a plurality of cylindrical bands mounted in said mixing frame and lying in the plane of the latter; a hub member concentrically located in each of said bands; a plurality of laterally curved, turbine blades fixedly mounted at their inner extremities in the hub member in each of said cylindrical bands and extending radially outward to fixed, uniformly spaced connections with the surrounding band, the blades in each band being pitched in a direction opposite to the pitch of the blades in adjacent bands to rotate the air passing through each band in a direction opposite to the air passing through the adjacent bands so that the total air will enter said chamber in a plurality of oppositely rotating whirling streams.

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