March 27, 1962 A. JUDET DE LA COMBE 3,026,787

INDUCTION AIR DISTRIBUTORS

Filed Oct. 7, 1957

Fig_1

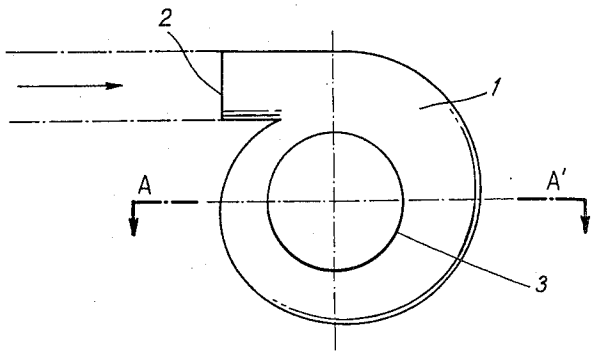


Fig_2

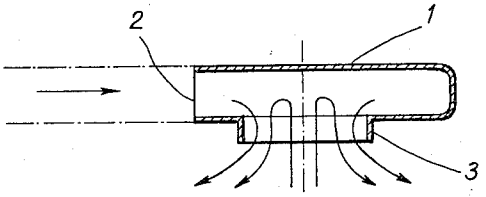


Fig_3

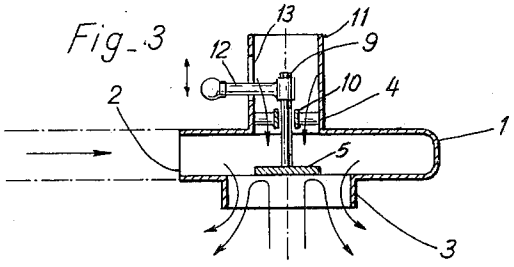
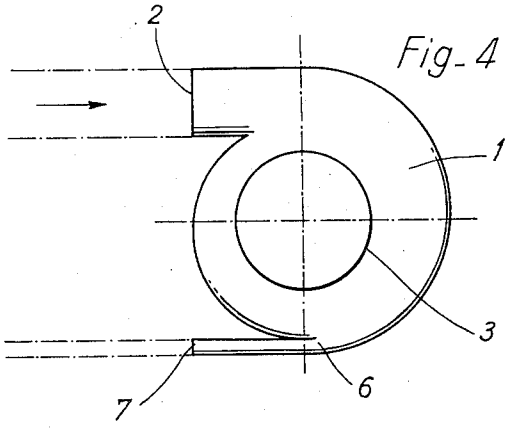


Fig_4



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United States Patent Office 3,026,787 Patented Mar. 27, 1962

3,026,787

INDUCTION AIR DISTRIBUTORS

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Filed Oct. 7, 1957, Ser. No. 688,696
4 Claims. (Cl. 98—41)

This invention relates to air distributors and has particular reference to improved induction air distributors. Induction air distributors characterized by the use of nozzles through which a so-called "primary" air current is forced are already known, these nozzles being located in ducts of adequate shape so that an external or secondary air stream is created therein.

The mixture of primary and secondary air is then distributed in the space or room subsequent to a complementary treatment, such as heating, cooling, etc.

In all cases, a dilution of the primary air in the secondary air takes place, which occasions a homogeneity, as the primary air may have a very low or a very high temperature; the mixture of primary and secondary air will have a temperature close to that of the air in the room.

However, in existing nozzle systems the efficiency of the operation is very poor for it is well known that the efficiency of induction systems of this character which utilize the kinetic energy of the primary air is quite moderate. Apparatus of this type actually require for their operation high running pressures of the order of 50 to 100 mm. of Hg.

Now such high pressures lead to serious inconveniences, notably that of making the air-distributing apparatus rather noisy, unless it is provided with a cumbersome sound-insulating device which is costly both to manufacture and in the energy required for overcoming its inherent losses of pressure.

It is the essential object of this invention to provide an induction air distributor consisting of a single spiral-shaped passage in which the air is introduced tangentially so as to create a velocity field similar to that of the so-called whirling type wherein the speed increases towards the centre at a rate inversely proportional to the radius.

This passage will preferably consist of a spiral volute with a tangential inlet and an outlet port located on one side of the volute. If desired, this volute may comprise on the side opposite to the outlet port a secondary air inlet.

According to another feature of this invention, the distributor is provided at its periphery with a pipe or like member for discharging the dust particles centrifuged during the passage of the air stream through the apparatus.

Other features and advantages of the invention will appear as the following description proceeds with reference to the accompanying drawing forming part of this specification and illustrating diagrammatically by way of example a few forms of embodiment of the invention. In the drawing:

FIGURE 1 is a diagrammatic elevational view showing a distributor constructed in accordance with the teachings of this invention;

FIGURE 2 is a section taken upon the line A—A of FIG. 1;

FIGURE 3 is a section similar to FIG. 2 but showing a modified embodiment comprising a secondary air inlet, and

FIGURE 4 is a diagrammatical elevational view showing a distributor provided with a pipe for discharging the centrifuged dust particles.

Referring to the drawing it is shown therein that the induction air distributor according to the invention consists of a spiral-shaped volute 1 having a tangential air inlet

2 and an air outlet port 3 on one of the lateral faces of the volute.

The air entering at 2 assumes a rotatory movement about the axis of the volute and as it attains the edge of the outlet port 3 it has a high tangential velocity and is distributed in radial directions in the room as in the case of radial diffusing air vents.

However, the field of speeds is such that in the vicinity of the volute axis the static pressure becomes strongly negative, thus creating a strong induction of air from the surrounding atmosphere, this air entering the distributor in large quantity. This air is carried along by the rotatory movement in admixture with the primary air and is finally discharged therewith as it attains the edge of the volute. This discharge takes place, as already stated, in the fashion of a radial diffusing air vent.

Thus, an induction air distributing apparatus is obtained which does not comprise any duct or nozzle bound by walls between which the primary air flows at high speed and around which the secondary air is carried along by friction at the outlet of this duct or nozzle.

On the contrary, in this improved device the primary air and the secondary air are caused progressively to contact each other inside the non-partitioned volume, over a large surface and according to a law of the vortex tube, this form of acceleration is characterized by a high efficiency and has frequently been utilized in many industrial applications.

With this system, an induction air distributor—which may be termed "internal induction distributor"—is obtained; it requires a moderate energy and therefore its internal pressure loss is kept to a low level so that a device constructed according to this invention operates without any sound insulating means with low-powered ventilators affording a substantial saving in power; moreover, these ventilators have a moderate peripheral velocity and operate noiselessly, so that no costly sound-insulating devices are required for overcoming their inherent loss of pressure.

On account of the negative pressure existing in the central zone of the spiral-shaped distributor it is possible, according to another specific form of embodiment of the device of this invention which is shown in FIG. 3 of the drawing, to provide an orifice 4 of smaller diameter than and opposite to the outlet port 3 for exhausting air from this opposite side either directly or through a pipe or duct, the thus exhausted air being for example external air, i.e. exterior to the sheath 2, to the volute 1 and/or the space communicating with the outlet 3.

In combination with this exhaust system it is possible to provide a regulating device consisting for example of a shutter 5 adapted to be displaced in the axial direction by means of a rod 9 solid therewith for adjusting the volume of air taken from the room in which the distributor is mounted.

By moving the shutter 5 from the orifice 4 to the port 3 in a continuous, adjustable manner it is possible to vary at will the input of air flowing through one or the other aperture, so that the inputs entering on both sides may be reduced or mixed in any suitable proportions. For the displacement of the shutter 5, the rod 9 carrying the shutter is disposed to slide in a supporting spider 10 mounted in the pipe 11 communicating with the opening 4. A control arm 12 is connected to the rod 9 and laterally extends therefrom and is slidably disposed in an axial slot 13 in the pipe 11.

To create a so-called "whirl type" field of velocities one may use not only the device cited by way of example in the preceding example, which comprises a volute, but also any other system, for example a movable set of blades disposed annularly around the circular air outlet 3, this set of blades being mounted in an inlet

case of adequate, non-directional shape, or a rectilinear set of blades disposed at the inlet of the case and adapted to deflect the air stream at the case inlet so as to subsequently create the "whirl tube."

The device according to this invention is also characterized by the essential advantage that a rotatory movement is imparted to the air therein and that the velocity of the air flow in the vicinity of the outlet port **3** is greater than that at the inlet **2**; now, it is known that in a whirling zone of speed the dust particles, droplets, etc., and, as a rule, all foreign substances, are subjected to a field of centrifugal forces the action of which varies according to the specific weight, size and shape of the particles.

A known device called "cyclone" is based on this principle.

An internal-induction air distributor constitutes, due to its specific mode of operation, a cyclone in which the separation of certain dust particles, droplets, soot particles, etc., is obtained, whereby the distributor acts as a dust separator not only as regards the primary air induced in the inlet **2** but also as regards the secondary air taken from the room and induced in the volute **1**.

The dust particles, droplets and like foreign substances rotating in the whirl tube are gradually forced outwards by the centrifugal force and collected on the outer walls of the volute where they can be gathered in a slot or in any other suitable device, for example a port **6** as shown in FIG. 4. Then the dust-ladden air is expelled through a pipe **7** and either vented or filtered prior to being recycled.

Although the attached drawings show only a few diagrammatic examples of devices constructed according to this invention, it will be readily understood by anybody conversant with the art than many changes may be brought to the shapes, relative proportions and materials utilized in this construction without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. An internal-induction air distributor comprising a spiral shaped, internally unobstructed-to-spiral-movement-of-air diffusion body having a peripheral wall formed with a tangential air inlet adapted to be fed by a source of air under pressure and said body having opposing sides, one of said sides being formed with a circular air outlet opening of a smaller diameter than the diameter of the body and the opposing side being formed with a circular central air inlet disposed concentric with and of smaller diameter than the outlet and a shutter positioned in the body tranverse to the axis of the central air inlet between the central air inlet and the air outlet and movable between the central air inlet and the air outlet relative to the air inlet for closing off said air inlet.

2. An internal-induction air distributor comprising a spiral shaped, internally unobstructed-to-spiral-movement-of-air diffusion body having a peripheral wall formed with a tangential air inlet adapted to be fed by a source of air under pressure and said body having opposing sides, one of said sides being formed with a circular air outlet opening of a smaller diameter than the diameter of the body and the opposing side being formed with a circular central air inlet disposed concentric with and of smaller diameter than the outlet and a shutter positioned in the body transverse to the axis of the central air inlet between the central air inlet and the air outlet and said shutter being in the form of a disc of a diameter substantially equal to the diameter of the central air inlet and being movable relative to said air inlet to close off said air inlet.

3. An internal-induction air distributor comprising a spiral shaped, internally unobstructed-to-spiral-movement-of-air diffusion body having a peripheral wall formed with a tangential air inlet adapted to be fed by a source of air under pressure and said body having opposing sides, one of said sides being formed with a circular air outlet opening of a smaller diameter than the diameter of the body and the opposing side being formed with a circular central air inlet disposed concentric with and of smaller diameter than the outlet and a shutter positioned in the body transverse to the axis of the central air inlet for movement between the central air inlet and the air outlet and said shutter being in the form of a disc of a diameter substantially equal to the diameter of the central air inlet to close off said air inlet with said disc being axially displaceable in the body.

4. An internal-induction air distributor comprising a spiral shaped internally unobstructed-to-spiral-movement-of-air diffusion body having a peripheral wall and opposing sides, one of said sides being formed with an air outlet of a smaller diameter than the diameter of the body and said peripheral wall of said body having a tangential air inlet adapted to be fed by a source of air under pressure and being formed with a tangential orifice for discharging the dust particles centrifugated in the body and the opposing side having a circular air inlet disposed concentric to the air outlet and being of less diameter than said air outlet and a shutter positioned in the body transverse to the axis of the circular air inlet and disposed for axial movement in the body relative to the air inlet and the air outlet in the sides.

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