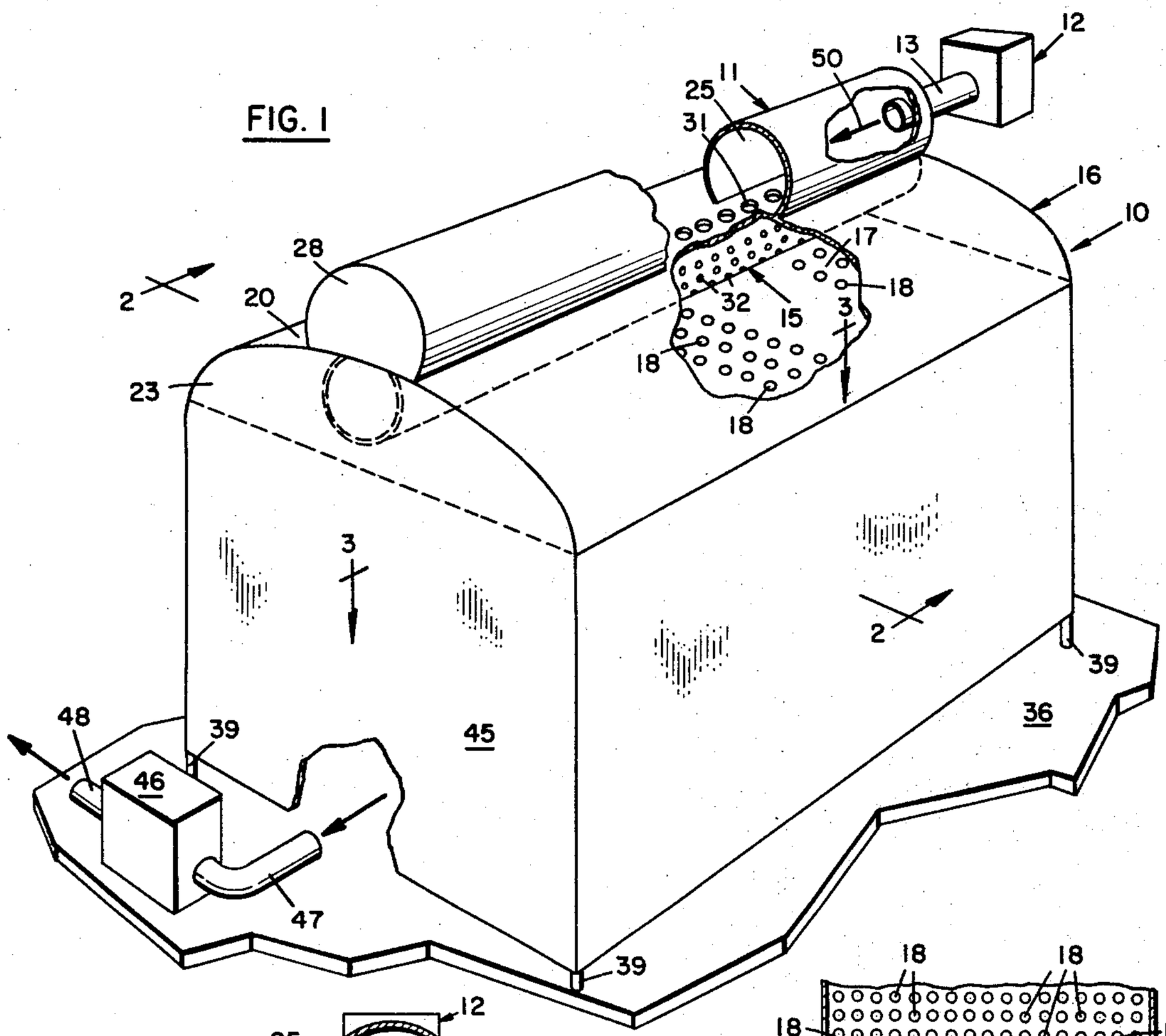
Jan. 16, 1968 J. P. HORNEFF 3,363,532

GAS-CIRCULATING MEANS

Filed Dec. 1, 1965

FIG. 1



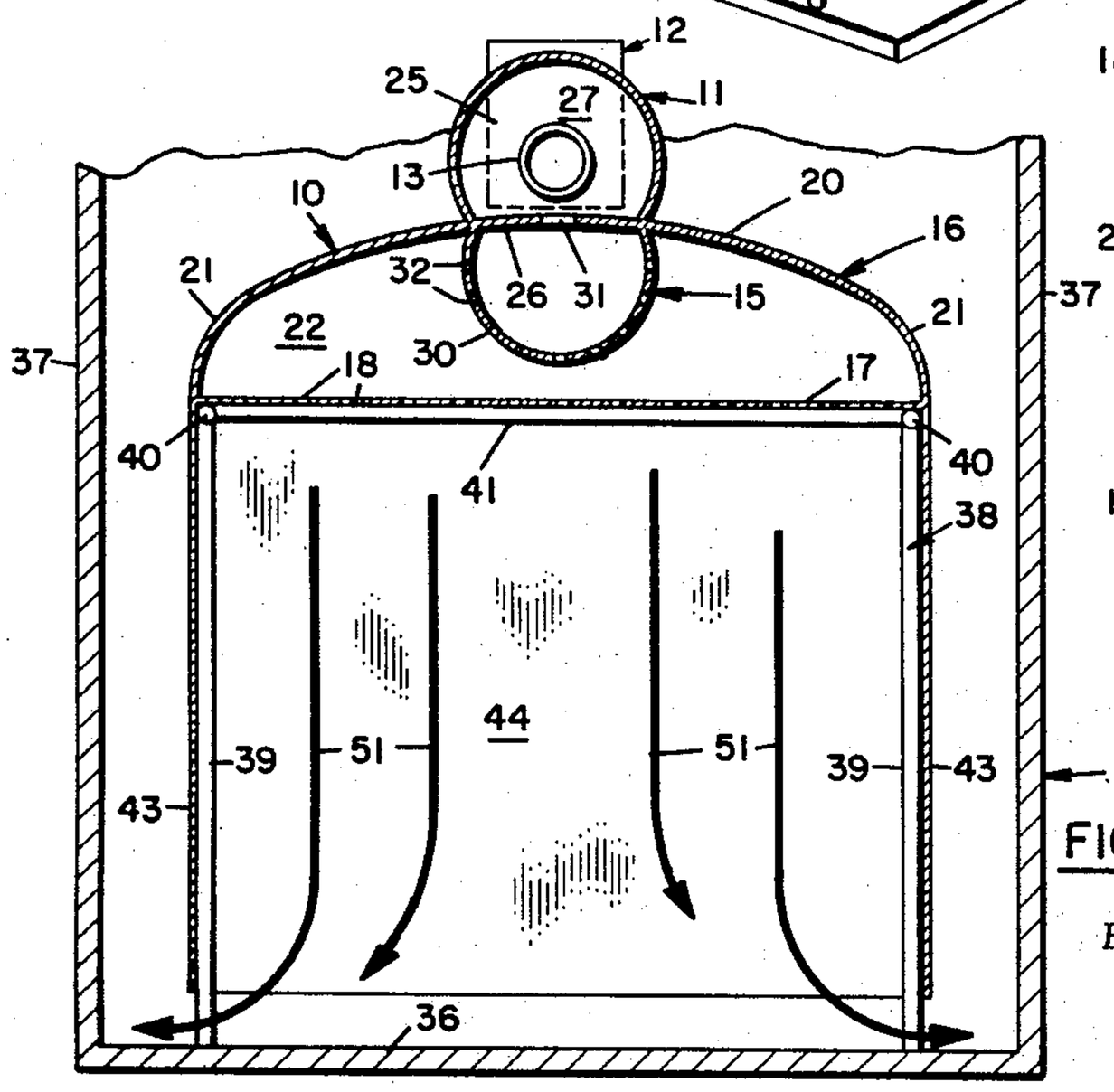


FIG. 2

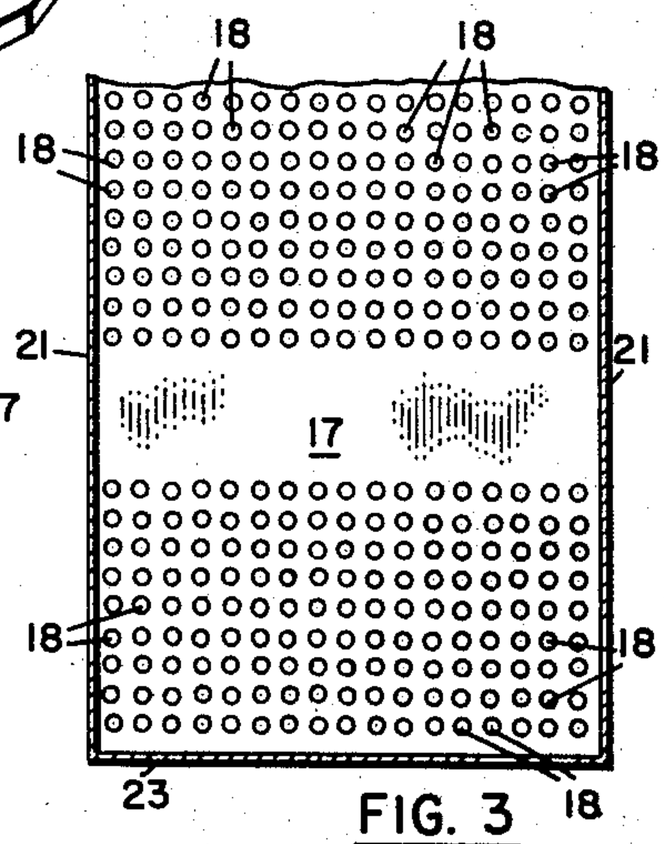


FIG. 3

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GAS-CIRCULATING MEANS

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ABSTRACT OF THE DISCLOSURE

This invention is concerned essentially with gas-circulating means including elongate inlet and distribution chambers in communication with each other, and a discharge chamber spacedly surrounding the distribution chamber for receiving gas from the latter and having a perforate wall for discharge therethrough of received gas.

This invention relates generally to the circulation of gas, being primarily concerned with the circulation of air in a relatively streamline or laminar flow.

As is well known to those versed in the art, the terminology "a clean room" is conventionally employed to designate a space having purified and controlled atmosphere, and advantageously having a minimum of turbulence in air flow.

It is an important object of the present invention to privide gas- or air-circulating means adapted for use in a clean room which achieves relatively streamline flow with a minimum of turbulence.

It is another object of the present invention to provide a gas- or air-circulating means of the type described which is extremely simple in construction and operation, and which is durable and reliable throughout a long useful life.

It is still a further object of the present invention to provide gas- or air-circulating means having the advantageous characteristics mentioned in the preceding paragraphs, which is adapted to be fabricated to flexible sheet material for convenience in erection, dismantling, storage and transit.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

In the drawings:

FIGURE 1 is a top perspective view illustrating gas-circulating means constructed in accordance with the teachings of the present invention, partly broken away for clarity of understanding;

FIGURE 2 is a sectional elevational view taken generally along the line 2—2 of FIGURE 1; and

FIGURE 3 is a partial horizontal sectional view taken generally along the line 3—3 of FIGURE 1.

Referring now more particularly to the drawings, and specifically to FIGURES 1 and 2 thereof, gas-circulating means of the present invention is there generally designated **10**, and may include an elongate, generally tubular inlet chamber **11** having a gas-input means **12**, such as a blower connected in fluid communication, as by conduit **13** with one end of the chamber **11**. In the illustrated embodiment the chamber **11** extends generally horizontally, and extending horizontally along the underside thereof is an elongate, tubular distribution chamber, generally designated **15**. In addition, a discharge chamber

16 is longitudinally coextensive with and effectively encloses the distribution chamber **15**.

More specifically, the discharge chamber **16** may include a generally flat, substantially rectangular lower wall **17** formed with a plurality of thru openings **18**. As seen in FIGURE 3, the arrangement of openings **18** may be that of a medial group spaced between the ends of the wall **17**, and end groups adjacent to respective ends of the wall. Other arrangements of openings **18** may be provided, if desired. The discharge chamber **16** further includes an upper wall **20** extending spacedly over the lower wall **17** and having side portions **21** depending from opposite sides to respective side edges of the lower wall **17**. In practice, the upper wall **20** may be generally arcuate in a plane transverse of the lower wall **17**. At opposite ends of the discharge chamber **16** there may be provided generally upright end walls **22** and **23** each extending upward from a respective end of the lower wall **17** to the adjacent edges of the upper and side walls **20** and **21**.

The elongate inlet chamber **11** may be defined by an elongate, generally cylindrical wall **25** having a cross section, best seen in FIGURE 2, approximating an arcuate segment of greater than 180 degrees. Thus, the inlet chamber **11** may approximate a chordally truncated cylinder extending longitudinally along and contiguous to the laterally medial or uppermost region of the arched discharge chamber wall **20**. In practice, opposite longitudinal edges of the arcuate inlet-chamber wall **25** may be secured, by any suitable means, to the upper wall **20** of discharge chamber **16**, extending longitudinally therealong adjacent to and on opposite sides of the longitudinal centerline thereof. Thus, the longitudinally extending medial region **26** of upper discharge-chamber wall **20** may define the lower wall of inlet chamber **11**. Opposite ends of the inlet chamber **11** are closed by respective end walls **27** and **28** generally coplanar with end walls **22** and **23**. The gas-supply conduit **13** may enter through inlet-chamber end wall **27**.

Immediately beneath the inlet chamber **11**, extending longitudinally therealong and coextensive therewith, is the distribution chamber **15**. The distribution chamber **15**, located within the discharge chamber **16**, may also be of generally truncated cylindrical configuration, having an elongate wall **30** of a constant cross-sectional configuration approximating an arcuate segment of greater than 180 degrees. The wall **30** may have its longitudinal edges secured, by any suitable means, to the upper wall **20** of the discharge chamber, extending longitudinally therealong adjacent to and on opposite sides of the longitudinal centerline thereof. If desired, the longitudinal side edges of the distribution-chamber wall **30** may extend contiguous to respective longitudinal edges of the inlet-chamber wall **11**, on opposite sides of the discharge-chamber wall **20**. Opposite end edges of the distribution-chamber wall **30** may be secured to respective end walls **22** and **23** of the discharge chamber **16**. Further, as will appear in the drawings, the distribution-chamber wall **30** is spaced over the lower discharge-chamber wall **17**, as well as being spaced from the side-wall portions **21** of the discharge chamber.

It will now be appreciated that the longitudinally extending medial wall portion **26** of upper discharge-chamber wall **20** is common to both the inlet chamber **11** and distribution chamber **15**, being respectively the lower and upper walls thereof. Further, the common wall portion **26** is provided with means for fluid communication between the inlet and distribution chambers, as by a series or row of thru openings **31**. The openings **31** may be arranged in spaced relation longitudinally along the extent of common wall portion **26**. In addition, the distribution-chamber wall **30** is provided with a plurality of

fluid passageways, as by thru openings or holes **32**, which are arranged in spaced relation longitudinally along the wall **30**, as well as circumferentially thereabout. By this means, gas entering the inlet chamber **11** may pass therefrom through the openings **31** to the distribution chamber **15**, and thence pass from the distribution chamber in angularly spaced radial directions outward from the wall **30**.

While the structure, as thus far described, may be of a rigid or self-sustaining construction, it has been found advantageous to fabricate the inlet, distribution and discharge chambers **11**, **15** and **16** of flexible sheet material, such as relatively impervious fabric, as for economy, as well as ease of erection, dismantling, storage and transit.

In fabrication of the inlet, distribution and discharge chambers **11**, **15** and **16** of flexible sheet material, it is preferable that the effective area of distribution-chamber openings **32** is at least equal to or greater than the effective area of discharge-chamber openings **18**. In this manner, the discharge chamber **16** and distribution chamber **15** are maintained in their distended, setup condition, as illustrated, by the internal gas pressure. Similarly, the effective area of openings **31** is such as to maintain the inlet chamber **11** in its distended, setup condition by the internal gas pressure therein.

The gas-circulating means **10** is shown in FIGURE 2 as located in spaced relation within a room or enclosure **35**, having a bottom wall or floor **36**, and side walls **37**. In most practical applications, the inlet, distribution and discharge chambers **11**, **15** and **16** are located in elevated relation, as spaced over the floor **36** of room **35**. Any suitable supporting means may be provided for sustaining the chamber assembly **11**, **15** and **16** in its elevated condition, such as a supporting framework **38**, say of rectangularly arranged corner posts upstanding from the floor **36**, and horizontally disposed frame members extending between the upper ends of the posts, such as side members **40** and end members **41**. The frame members **40** and **41** thus define an open, rectangular frame comformably supporting the underside of the assemblage of inlet, distribution and discharge chambers **11**, **15** and **16**. If required, the lower discharge-chamber wall **17** may be suitably secured to the frame members **40** and **41**; and of course, other or additional supporting elements may be employed, if desired.

Depending from the side edges of lower wall **17**, substantially longitudinally coextensive therewith, may be side walls or curtain **43**, while a pair of end walls or curtains **44** and **45** may depend from opposite end edges of the lower discharge-chamber wall. The curtains or side walls **43**, **44** and **45** may also be of rigid or flexible sheet material, as desired, and may depend to the floor **36**, or terminate in spaced relation above the floor, as illustrated.

Communicating through one of the curtain walls **43**, **44** or **45**, or beneath one of the curtain walls, may be suitable gas-withdrawal means, such as an exhaust blower **46** having an inlet conduit **47**, and an outlet conduit **48**, as for recirculation to blower **12**.

In operation, air or other gas is moved into the inlet chamber **11**, as in the direction of arrow **50** along the entire length of the inlet chamber for passage therefrom through openings **31** into distribution chamber **15**. Passage of gas to all portions of distribution chamber **15** may be equalized by a suitable arrangement of openings **31**, if desired. From chamber **15**, the air or other gas is distributed radially outward to the interior of discharge chamber **16**. As the discharge chamber **16** is relatively large, air velocity therein is relatively low, and discharge from the chamber **16** takes place in smooth, downward, columnar flow through openings **18** within the space bounded by walls **43**, **44** and **45**. This relatively smooth, streamline or laminar flow is illustrated by arrows **51**, the gas passing downward to the floor **36**, and exiting between the lower edges of walls **43**, **44** and **45** and the floor, for withdrawal by the exhaust blower or fan **46**.

The relative absence of disturbance and high degree of streamline flow, as at **51**, has been found to provide a clean room of extremely high purity, sterility and cleanliness. In addition, the instant invention provides substantially equal airflow velocities downward away from the lower wall **17** over substantially the entire area thereof.

From the foregoing it will be seen that the present invention provides a gas-circulating means which fully accomplishes its intended objects, is well adapted to meet practical conditions of manufacture, installation, maintenance and use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claim is:

1. Gas-circulating means comprising an elongate inlet chamber for receiving gas to be circulated, an elongate distribution chamber extending longitudinally along said inlet chamber, fluid-communication means between said inlet and distribution chambers for passing gas from the former chamber to the latter chamber, said distribution chamber having fluid passageways therealong for passing fluid in angularly spaced directions from said distribution chamber, and a discharge chamber spacedly surrounding said distribution chamber for receiving gas from the latter, said discharge chamber having a plurality of openings in one wall thereof for discharge therethrough of received gas, said discharge chamber being fabricated of flexible sheet material, for support in distended relation by contained gas.

2. Gas-circulating means according to claim **1**, the effective area of said fluid passageways being at least approximately equal to that of said plurality of openings.

3. Gas-circulating means according to claim **1**, said inlet and distribution chambers being fabricated of flexible sheet material, for support in distended relation by contained gas.

4. Gas-circulating means according to claim **3**, wherein the effective area of said fluid passageways in said distribution chamber is at least equal to the effective area of said plurality of openings in said discharge chamber.

5. Gas-circulating means according to claim **3**, wherein the effective area of the communication means between said inlet and distribution chambers is at least equal to the effective area of said fluid passageways of said distribution chamber.

6. Gas-circulating means comprising an elongate inlet chamber for receiving gas to be circulated, an elongate distribution chamber extending longitudinally along said inlet chamber, fluid-communication means between said inlet and distribution chambers for passing gas from the former chamber to the latter chamber, said distribution chamber having fluid passageways therealong for passing fluid in angularly spaced directions from said distribution chamber, and a discharge chamber spacedly surrounding said distribution chamber for receiving gas from the latter, said discharge chamber having a plurality of openings in one wall thereof for discharge therethrough of received gas, said inlet and distribution chambers each extending generally horizontally with said distribution chamber located below said inlet chamber, one wall of said discharge chamber extending generally horizontally beneath said distribution chamber, for discharging gas downwardly in generally vertical columns, guide means depending from said one wall about the periphery thereof for guiding discharged gas downwardly away from said one wall, and gas-withdrawal means spaced below said discharge chamber for withdrawing gas away from said one wall downwardly in said guide means, said discharge chamber being fabricated of flexible sheet material, for support in distended relation by contained gas.

7. Gas-circulating means comprising an elongate inlet chamber for receiving gas to be circulated, an elongate distribution chamber extending longitudinally along said inlet chamber, fluid-communication means between said inlet and distribution chambers for passing gas from the former chamber to the latter chamber, said distribution chamber having fluid passageways therealong for passing fluid in angularly spaced directions from said distribution chamber, and a discharge chamber spacedly surrounding said distribution chamber for receiving gas from the latter, said discharge chamber having a plurality of openings in one wall thereof for discharge therethrough of

received gas, said discharge chamber being at least partially fabricated of flexible sheet material for partial support in distended relation by contained gas.

References Cited

UNITED STATES PATENTS

2,807,329	9/1957	Caldwell	98—40 X
3,004,277	10/1961	Allred	98—40 X
3,229,609	1/1966	Larson	98—40 X

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