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Culpepper, Jr. et al.

[11] **3,880,062**

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[54] **HOOD**

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[52] **U.S. Cl.** ..... **98/115 K;** 55/DIG. 36

[51] **Int. Cl.** **F23j 11/12**

[58] **Field of Search** ..... 98/115 K, 115 R; 55/DIG. 36

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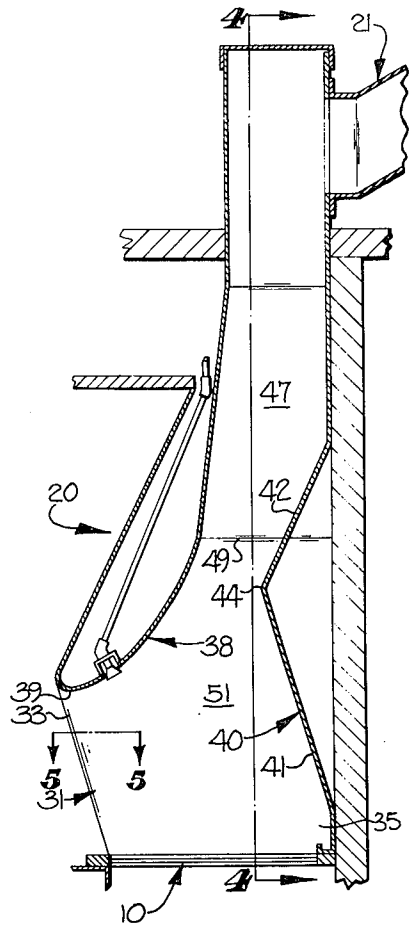
[57] **ABSTRACT**

Airborne particulate matter is efficiently entrained into an air flow while the volume of air flow required is minimized by a hood which has walls defining an aerodynamically curving flow path with an entrance face having a first cross sectional flow area and a throat zone spaced downstream of the entrance face and having a cross-sectional flow area less than that of the entrance face. The throat zone is defined by the cooperation of an aerodynamically curving interior forward wall and lower and upper portions of a rear wall which are respectively directed forwardly toward the front wall and rearwardly away from a work surface underlying the interior forward wall.

8 Claims, 5 Drawing Figures



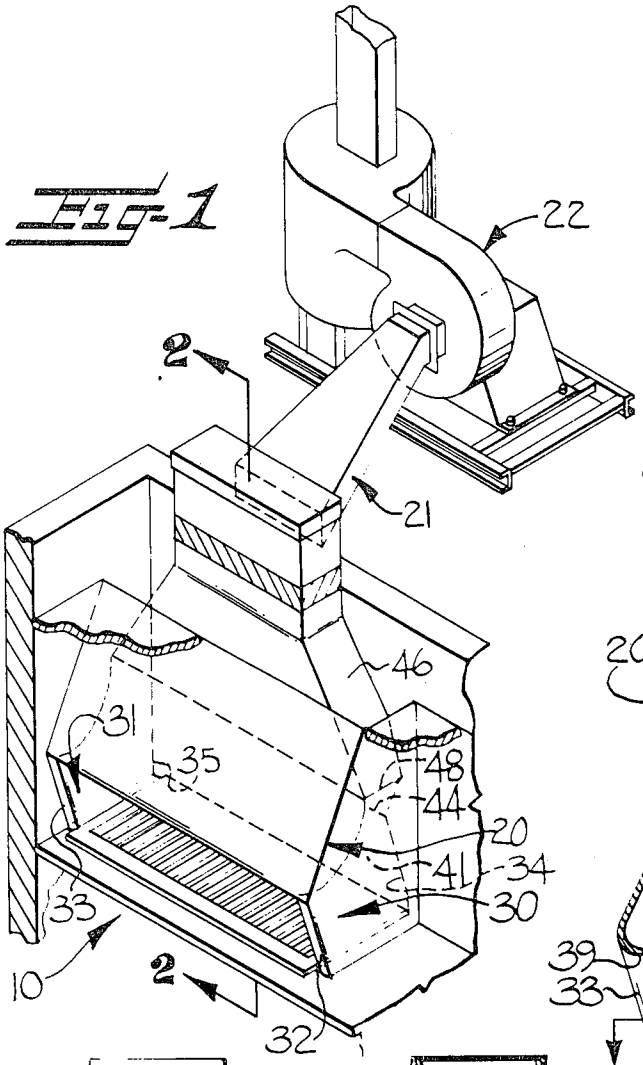


Fig-1

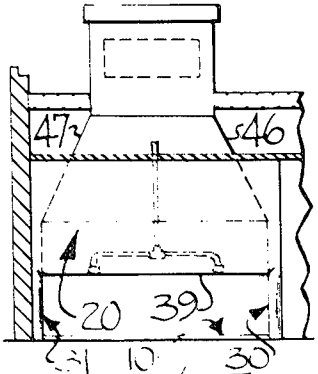


Fig-3

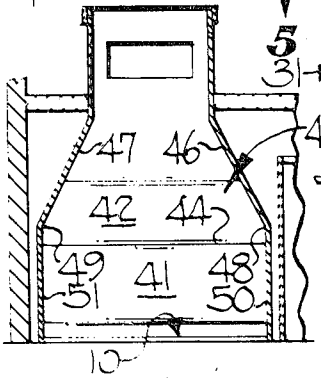


Fig-4

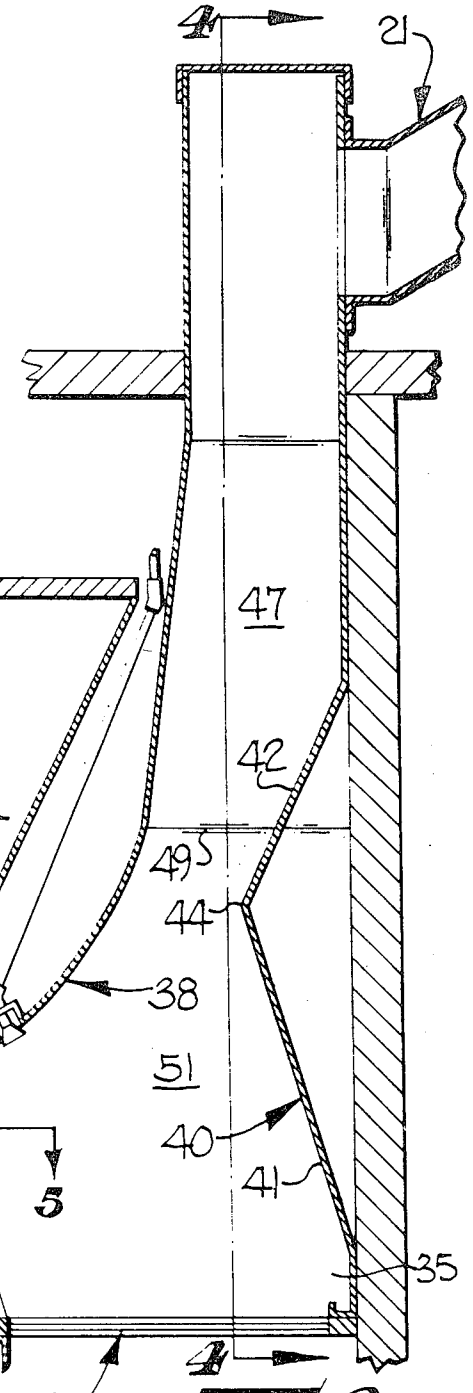


Fig-2

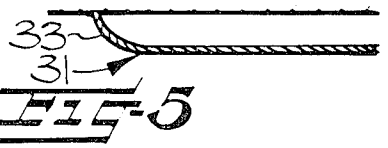


Fig-5

HOOD

Recent efforts toward control of air pollutants, such as airborne particulate matter, have brought increasing attention to certain problems relating to control of such materials. By way of specific example, airborne particles of grease originating from certain apparatus typically used in fast-service restaurants, such as charbroilers, have in the past been disposed of by arranging a ventilating system to have a hood overlying the work surface of the apparatus and inducing a flow of air through the hood. Particularly where the hood is located within a building structure where a controlled atmosphere is desired, it is necessary to provide "make-up" air to replace the quantity of air withdrawn through the ventilation system. Where high volumes of air are withdrawn, the supply of the necessary quantitites of conditioned make-up air presents difficulty.

Yet a further difficulty is encountered where air and entrained airborne particulate matter are delivered from the hood to a disposal device such as an afterburner. It has been discovered that the quantity of fuel required for proper disposal of the air pollutants is determined, at least in part, by the quantity of air necessary to entrain and deliver the particulate matter. Thus, where large volumes of air are required, large quantities of fuel are required and the expense of compliance with requirements for disposal is substantially increased.

Having in mind the aforementioned difficulties and deficiencies of prior arrangements, it is an object of this invention to efficiently entrain airborne particulate matter while minimizing the volume of air flow required. In accomplishing this object of the present invention, hood means having wall means which define a particularly configured flow path for air are provided. Particularly by the cooperation of a front wall defining an aerodynamically curving interior forward wall at least partially overlying a work surface and a rear wall having lower and upper portions which are respectively directed forwardly toward the front wall and rearwardly away from the work surface, a constant acceleration of air flow velocities is achieved between the entrance of air into the hood and a throat zone spaced above the work surface.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIG. 1 is a perspective view, partly broken away, of a ventilation system incorporating the present invention;

FIG. 2 is an enlarged side elevation view, partially in section, taken generally along the line 2—2 in FIG. 1;

FIG. 3 is a front elevation view of the apparatus of FIGS. 1 and 2;

FIG. 4 is a section view taken generally along the line 4—4 in FIG. 2; and

FIG. 5 is a section through a portion of the apparatus of FIGS. 1 and 2, taken generally along the line 5—5 in FIG. 2.

A ventilation system and hood means in accordance with the present invention have been illustrated in the accompanying drawing and will be described in the text which follows. The description and drawing refer to the best mode for the practice of this invention contemplated at the time that the description and drawing were prepared. However, it is contemplated that the

illustration and description of this invention will aid persons skilled in the art of ventilation generally to understand the wide applicability of this invention. For that reason, the illustration and description are to be understood broadly, rather than as restricting the scope of this invention.

The present invention has been illustrated in the accompanying drawings in an environment where a charbroiler, generally indicated at **10**, is disposed within a building and is used in cooking. As will be understood by persons familiar with such cooking apparatus, particulate grease becomes airborne during the operation of a charbroiler and removal of such airborne particulate matter from the area of the work surface defined by the charbroiler is necessary. As will be recognized, the charbroiler **10** is of known side-to-side and front-to-rear dimensions.

In accordance with this invention, hood means generally indicated at **20** overlies and substantially encloses the work surface, for guiding air flow thereover. The hood means operatively communicates with duct means generally indicated at **21** which in turn operatively communicates with a fan means generally indicated at **22**, by which flow of air is induced. Specific details of the duct means **21** and fan means **22** are not here disclosed, as such devices generally may be designed and selected by skilled ventilating engineers.

The hood means **20** comprises a plurality of related wall means which together define a flow path for air and entrained matter. In accordance with this invention, the flow path is configured for constant acceleration of air flow velocity between an entrance face adjacent the front side of the work surface or charbroiler **10** and a throat zone defined within the path as described more fully hereinafter. By such a constant acceleration of flow velocities, together with the use of aerodynamically curving surfaces, the volume of air flow required for entrainment of airborne particulate matter is minimized.

The wall means includes side wall means **30, 31** defining right and left side walls rising from adjacent the right and left sides of the work surface **10** and having front portions **32, 33** and rear portions **34, 35.** A front wall means generally indicated at **38** has a lower edge portion **39** spaced upwardly from the work surface **10** and generally overlying the front side thereof (FIGS. **1** and **2**). The front wall means **38** defines an aerodynamically curving interior forward wall which rises from the lower edge portion **39** (as best seen in FIG. **2**). Together, the lower edge portion **39** of the front wall means **38** and the front portions **32, 33** of the side wall means **30, 31** define with the work surface **10** an entrance face for the hood means **20,** through which air flow enters the hood means for entraining airborne particulate matter from above the work surface **10.**

In accordance with a significant feature of this invention, the front portions **32, 33** of the side wall means **30, 31** and the lower edge portion **39** of the front wall means **38** each define aerodynamically inward curving surfaces adjacent to the entrance face (FIGS. **2** and **5**). Such aerodynamic curving of surfaces adjacent the entrance face promotes smooth streamline flow of air entering the hood and avoids turbulent flow which otherwise possibly would result in expulsion of airborne particulate matter from the hood back into the interior of the building adjacent the work surface **10.**

Cooperating with the front wall means and side wall means is a rear wall means generally indicated at **40** which defines a rear wall rising from adjacent the rear side of the work surface. The rear wall means **40** has a lower portion **41** directed forwardly toward the front wall means **38** and an upper portion **42** directed rearwardly away from the work surface **10.** Preferably, and as shown, the lower and upper portions **41, 42** of the rear wall means diverge from a common horizontal edge **44** spaced upwardly from the work surface and the lower edge portion **39** of the front wall means **38.** At the horizontal edge **44,** the rear wall means **40** and front wall means **38** cooperate to define a throat zone which has a cross-sectional flow area less than the cross-sectional flow area of the entrance face described hereinabove. Further, the upper portion **42,** being directed rearwardly away from the work surface **10,** defines an expansion zone downstream of the throat zone which has a cross-sectional flow area greater than the cross-sectional flow area of the throat zone.

It is to be noted that the side wall means **30, 31** have lower portions which are parallel one to the other and have upper portions converging toward one another. The upper portions **46, 47** (FIGS. **3** and **4**) extend from respective common horizontal bend lines **48, 49** which separate them from the respective lower portions **50,** 51. The bend lines **48, 49** of the side wall means **30, 31** are spaced upwardly from the throat zone (FIGS. **1** and **2**) and cooperate with the front and rear wall means in bringing the cross-sectional area of the flow path to a known dimension downstream of the expansion zone discussed hereinabove.

It will be noted that, in operation, air entering at the hood means **20** adjacent the lower edge portion **39** of the front wall means **38** passes beneath a generally horizontal entrance face portion of the aerodynamically curved interior forward wall. Air entering near the lower end of the entrance face, immediately adjacent the work surface **10,** passes rearwardly over the work surface **10,** is heated, and rises toward the rear wall. As such rising air flow encounters the lower portion **41** of the rear wall, the flow is turned toward the throat zone, for mixing with air flow moving along the aerodynamically curved interior forward wall and is accelerated toward the reduced cross-sectional flow area to be found at the throat zone. Thus, efficient entrainment of airborne particulate matter is accomplished, while leakage of such matter back into the building interior is avoided and the volume of air flow required is minimized.

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

1. Hood means for efficiently entraining airborne particulate matter, such as originates from a charbroiler during cooking, from above a work surface of known side-to-side and front-to-rear dimensions while minimizing the volume of air flow required, said hood means comprising:

side wall means defining right and left side walls rising from adjacent the right and left sides of the work surface and having front and rear portions,

front wall means having a lower edge portion spaced upwardly from the work surface and generally overlying the front side thereof, said front wall means defining a smooth aerodynamically curving interior forward wall rising from said lower edge portion for assuring streamline flow of air therealong and within said hood means,

said front portions of said side wall means, said lower edge portions of said front wall means and the work surface together defining an entrance face for said hood means through which air flow enters for entraining airborne particulate matter from above the work surface, and

rear wall means defining a rear wall rising from adjacent the rear side of the work surface and having a lower portion directed forwardly toward said front wall means and an upper portion directed rearwardly away from the work surface,

said side wall means, front wall means, rear wall means and work surface together defining an at least substantially closed path for air flow, said front wall means and said rear wall means lower and upper portions together defining a throat zone within said air flow path, and the throat zone having a cross-sectional flow area less than the cross-sectional flow area of the entrance face.

2. Hood means according to claim **1** wherein said wall means together define a flow path for air and entrained matter configured for constant acceleration of flow velocities between the entrance face and the throat zone.

3. Hood means according to claim **1** wherein said upper portion of said rear wall means defines with said front wall means and said sidewall means an expansion zone downstream of the throat zone and having a cross-sectional flow area greater than the cross-sectional flow area of the throat zone.

4. Hood means according to claim **1** wherein said lower and upper portions of said rear wall means diverge from a common horizontal edge spaced upwardly from the work surface and said lower edge portion of said front wall means.

5. Hood means according to claim **1** wherein said sidewall means have lower portions parallel one to the other and have upper portions converging toward one another and further wherein said upper and lower portions diverge from respective common horizontal edges which lie in a common horizontal plane spaced upwardly from the throat zone.

6. Hood means according to claim **1** wherein said front portions of said sidewall means and said lower edge portions of said front wall means define aerodynamically inwardly curving surfaces at the entrace face.

7. Hood means according to claim **1** wherein said interior forward wall defined by said front wall means has a generally horizontal entrance face portion overlying the extreme front edge of the work surface.

8. A ventilation system for efficiently entraining airborne particulate matter, such as originates from a charbroiler during cooking, from above a work surface of known side-to-side and front-to-rear dimensions while minimizing the volume of air flow required, the system comprising:

duct means for conducting a flow of air and entrained matter,

fan means operatively communicating with said duct means for inducing flow of air and entrained matter therethrough, and

hood means for overlying the work surface and having wall means for directing air flow relative thereto, said wall means including

side wall means defining right and left side walls rising from adjacent the right and left sides of work surface and having front and rear portions,

front wall means having a lower edge portion spaced upwardly from the work surface and generally overlying the front side thereof, said front wall means defining a smooth aerodynamically curving interior forward wall rising from said lower edge portion for assuring streamline flow of air therealong and within said hood means,

said front portions of said side wall means, said lower edge portions of said front wall means and the work surface together defining an entrance face for said hood means through which air flow enters for entraining airborne particulate matter from above the work surface, and

rear wall means defining a rear wall rising from adjacent the rear side of the work surface and having a lower portion directed forwardly toward said front wall means and an upper portion directed rearwardly away from the work surface,

said side wall means, front wall means, rear wall means and work surface together defining an at least substantially closed path for air flow into said duct means, said front wall means said rear wall means lower and upper portions together defining a throat zone within said air flow path, and the throat zone having a cross-sectional flow area less than the cross-sectional flow area of the entrance face.

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