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Crawford

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(54) **FOAMING MACHINE**

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(51) **Int. Cl.**

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F23D 14/62	(2006.01)
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A63H 33/30	(2006.01)

(52) **U.S. Cl.** **239/418**; 239/8; 239/10; 446/15; 446/16; 446/17; 446/18; 446/20; 446/21; 446/22; 446/475

(58) **Field of Classification Search** 446/15–21, 446/176, 180, 186, 197, 267, 475; 239/418; 261/DIG. 26; 56/371, 229
See application file for complete search history.

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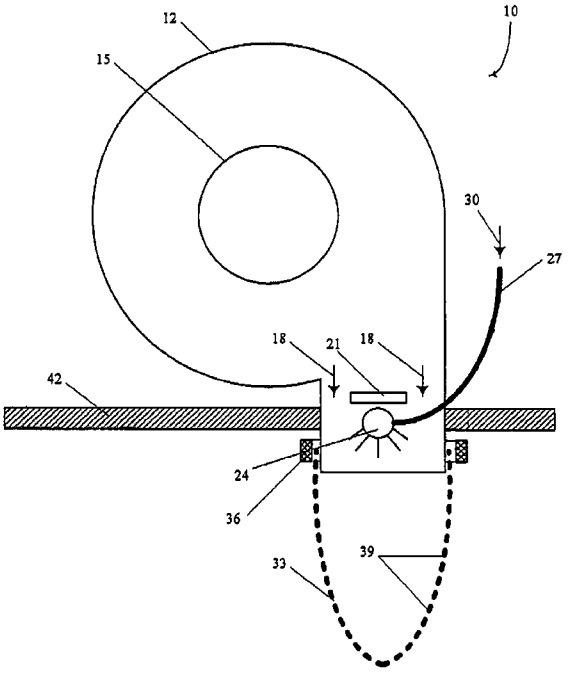
(57) **ABSTRACT**

The present invention provides an assembly, sock, and method for generating foam. The assembly includes a housing having a chamber, and a first and second orifice. A fan arranged within the housing draws a flow of air into the chamber through the first orifice and exhausts the flow of air through the second orifice to form an exhausted flow of air. A nozzle is arranged within the chamber and is situated in proximity to the second orifice to allow introduction of a fluid into the exhausted flow of air through the second orifice. A permeable sock includes an inner surface and an outer surface. The sock is arranged to occlude the second orifice in a manner to receive the exhausted flow of air with the fluid at the inner surface.

12 Claims, 2 Drawing Sheets



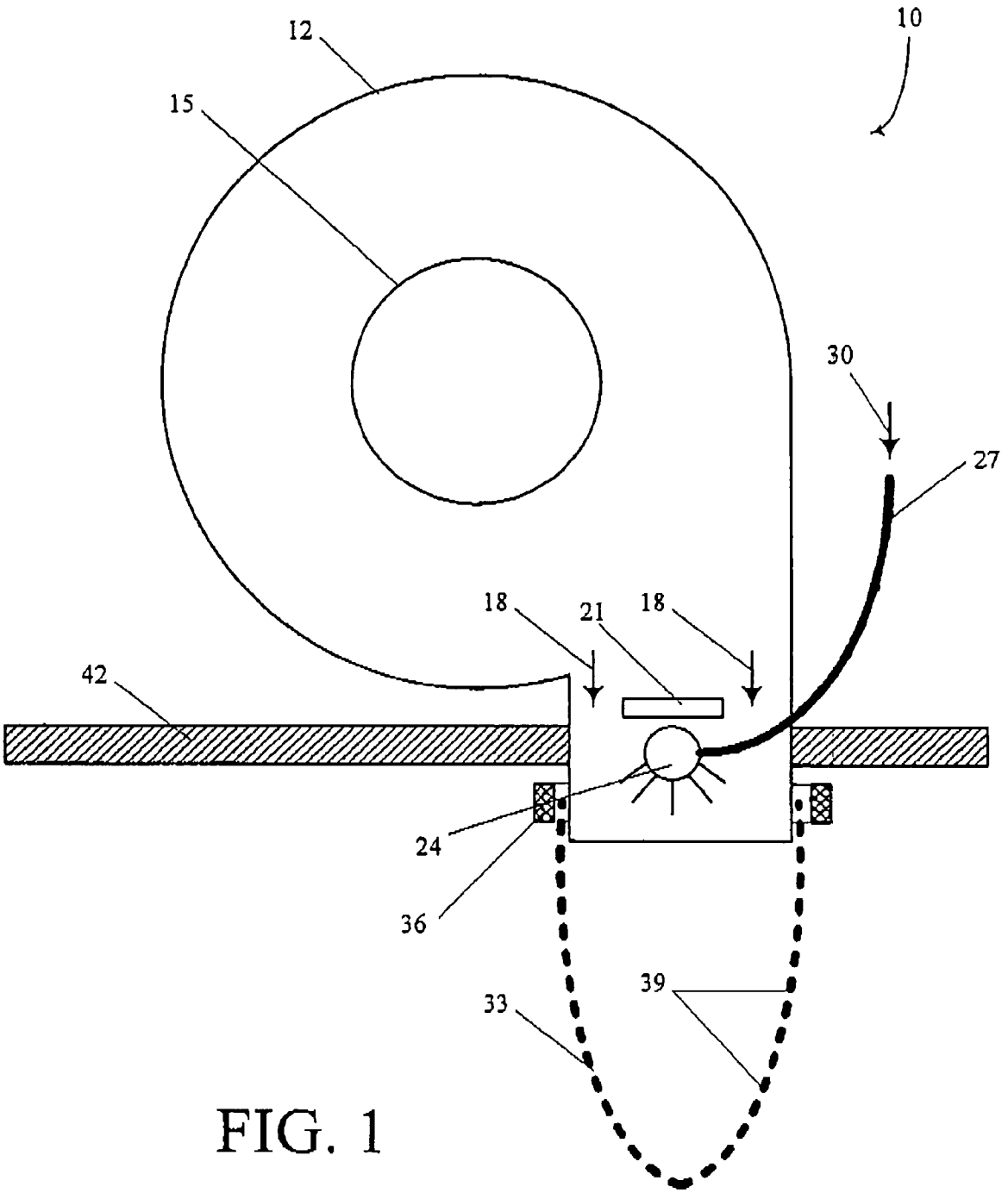


FIG. 1

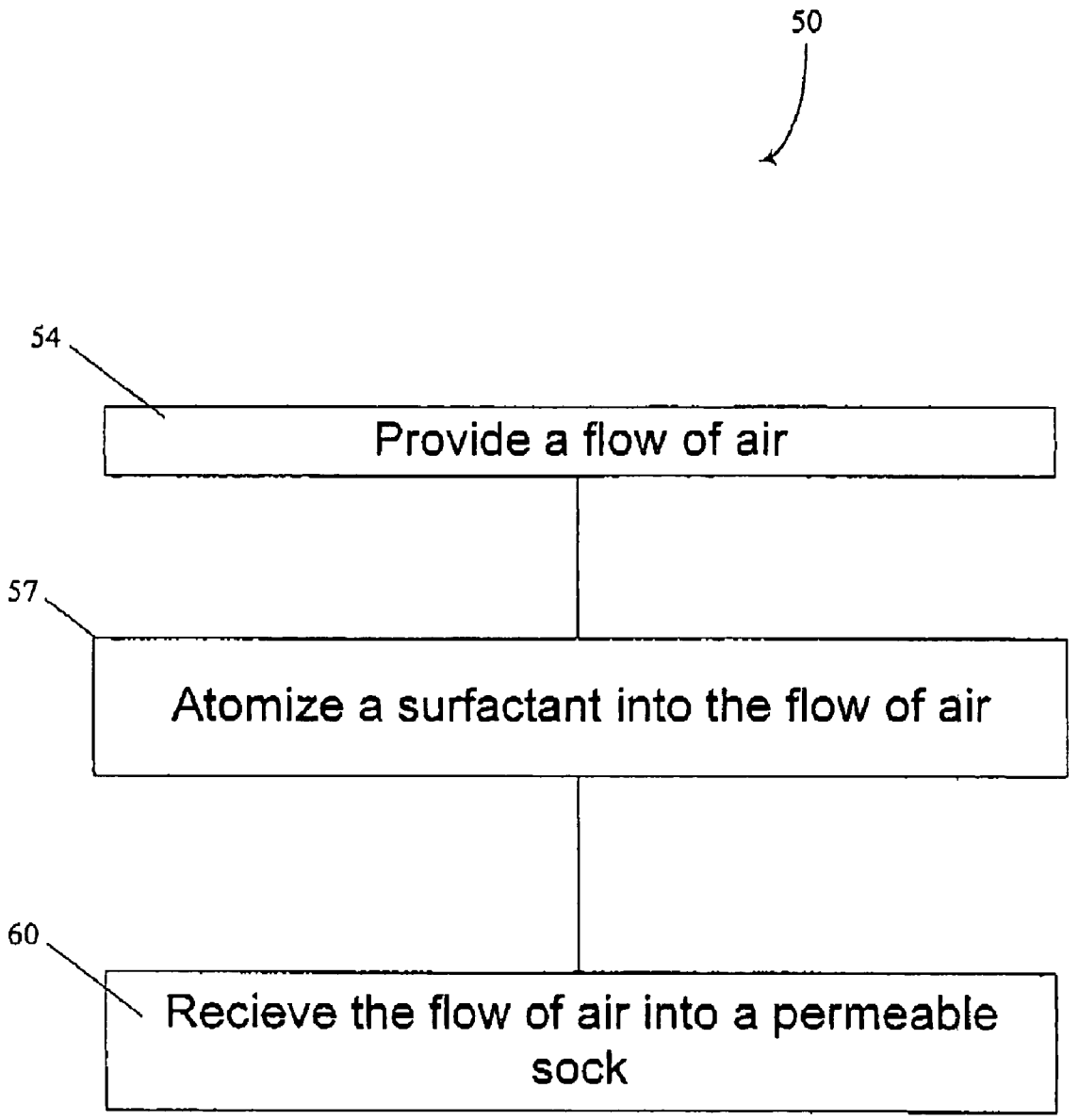

50
54
Provide a flow of air
57
Atomize a surfactant into the flow of air
60
Recieve the flow of air into a permeable sock

FIG. 2.

FOAMING MACHINE

RELATED APPLICATIONS

This application claims priority from the provisional application Ser. No. 60/397,237 filed on Jul. 18, 2002. The provisional application is hereby incorporated by this reference.

BACKGROUND OF THE INVENTION

For the past several years, industrial fires have been fought using a variety of surfactant foams. A foam generator comprised of a specialized nozzle for entraining air and surfactants into a stream of water, was used to create the fire fighting foam. Such a foam generator would both generate and propel foam for fighting industrial fires.

The foam generator was introduced in Europe for use in nightclubs and in stage productions, and is being advantageously used in entertainment settings for theatrical effect. The foam generator of the present invention is similar to currently available fire fighting foam generators, but the surfactants used in this presently preferred embodiment are altered to make the product more suitable for ease in dispersing and cleaning up after use.

However, creating foam in stage production environments does require the foam generator to disperse large amounts of water to entrain the air and surfactants. The problem presented herein is that a large amount of water remains after the theatrical effect is completed. The dispersed water could harm environments where the foam generator is used. For example, floors and ceilings might suffer damage from the abundance of the remaining water. This damage would likely cause users to stop using the currently available foam.

Therefore, there is currently an unmet need in the art for a foam generator that would generate great amounts of foam while using much less water than currently available foam generators.

SUMMARY OF THE INVENTION

The present invention provides an assembly, sock, and method for generating foam. The assembly includes a housing having a chamber, and a first and second orifice. A fan arranged within the housing draws a flow of air into the chamber through the first orifice and exhausts the flow of air through the second orifice to form an exhausted flow of air. A nozzle is arranged within the chamber and is situated in proximity to the second orifice to allow introduction of a fluid into the exhausted flow of air through the second orifice. A permeable sock includes an inner surface and an outer surface. The sock is arranged to occlude the second orifice in a manner to receive the exhausted flow of air with the fluid at the inner surface.

The sock is selected for its permeability to optimize the relationship between the volume of foam generated and the amount of fluid necessary to generate the foam, such that the smallest amount of fluid generates the greatest volume of foam.

Because the assembly allows the generation of the flow of air to occur remotely from the sock, the configuration of the assembly can be further optimized to ensure that the noise primarily remains at the sock, where the foam is generated. This quality of the present invention allows use of the foam for theatrical effect with a minimal amount of distraction from the theatrical event the effect is to enhance.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIG. **1** is a cut-away view of the foam generating assembly; and,

FIG. **2** is a flow chart of the method for generating the foam.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

By way of overview, the present invention provides an assembly, sock, and method for generating foam. The assembly includes a housing having a chamber, and a first and second orifice. A fan arranged within the housing draws a flow of air into the chamber through the first orifice and exhausts the flow of air through the second orifice to form an exhausted flow of air. A nozzle is arranged within the chamber and is situated in proximity to the second orifice to allow introduction of a fluid into the exhausted flow of air through the second orifice. A permeable sock includes an inner surface and an outer surface. The sock is arranged to occlude the second orifice in a manner to receive the exhausted flow of air with the fluid at the inner surface.

FIG. **1** depicts a cut-away view of a foam generating machine **10**. A housing **12** defines a chamber. In conjunction with the fan **15**, the housing **12** motivates a flow of air **18**. Any of several blower mechanisms will work to motivate the air to form and to direct the flow of air **18**, however, for purposes of illustrating the present invention, a squirrel-cage blower is shown. The minimum configuration necessary is for the flow of air **18** to be generated within the housing **12**. For example, where suitably pressurized air is provided, the configuration might only comprise the housing **12** for receiving pressurized air in order to create the flow of air **18** within the housing **12**. In the presently preferred and illustrated embodiment, the fan **15** is turned by an electric motor (not shown) drawing air through a first orifice (not shown) to generate the flow of air **18** within the housing **12**.

At the point of the flow of air **18**, a nozzle **24** atomizes a fluid **30** into the airflow **18**. An air dam **21** interrupts the flow of air **18** in the vicinity of the nozzle **24** in order to optimize the atomization of the fluid **30** at the locus of the flow of air **18** within the housing **12**. To supply the nozzle **24** with fluid **30**, a supply line **27** is provided. In one presently preferred embodiment, the fluid **30** is fed through the supply line **27** by a motorized pump (not shown) drawing fluid **30** from a tank (not shown). The presently preferred embodiment includes a switching network (not shown) to simultaneously power the motor (not shown) turning the fan **15** and the motorized pump.

Foam is generated by passing the atomized fluid **30** into the flow of air **18** through a permeable sock **33** that is detachably affixed to the housing **12** by a clamp **36** or other clamping mechanism. The sock **33** provides a medium to hold the atomized fluid **30** against the flow of air **18** in order to create a volume of bubbles. The volume of bubbles is known as foam. The permeability of the sock **33** is a function of the presence of a plurality of apertures **39**.

In another embodiment, the sock **33** is formed by a woven textile fabric, as in the presently preferred embodiment, the apertures **39** are defined by the warp and woof of the textile fabric. The size of the aperture **39**, the spced of the fan **15**, and the pressure and quality of the fluid **30** determine the size and texture of the formed bubbles.

The presently preferred embodiment utilizes a woven textile fabric that is an olefin such as is commonly used in the material used for lawn-mower bags, having open weave defining apertures on a magnitude of approximately $1/16^{th}$ of an inch.

The flow of air **18** past the nozzle **24** entrains the atomized fluid **30** to create a mixture of air and fluid **30** that is distributed over an inner surface of the sock **33**. The fluid **30** may be any suitable surfactant solution such as Foam Dome™ fluid and coats the inner surface of the sock **33**. As the flow of air **18** produces an air pressure differential between the inner and outer surfaces of the sock **33**, the flow of air **18** continues through the apertures **39** to form bubbles. These bubbles are collectively known as the foam.

The foam continues to generate to form a continuous material. As more and more foam continues to form, it occupies a larger and larger volume. The foam tends to expand outwardly from the socket **33**. The shield **42** keeps foam from entering an air intake of the fan **15**. The shield **42** is preferably made from a lightweight material to facilitate the portability of the foam machine **10**. In another presently preferred embodiment, the shield may form a conduit such as a pipe, providing foam distribution in a current of air to carry the foam away from the foam generating machine **10**.

As will readily be appreciated by those skilled in the art, the foam generating machine **10** may be hung by its housing **12** to allow walking passage underneath the unit without touching it. It may also be placed on a floor to distribute a carpet of foam. In still other presently preferred embodiments, the foam machine **10** may be fixedly attached to a second machine configured to provide a current of air to distribute the foam.

Referring to FIG. **2**, a flow chart illustrates a method **50** for the generation of foam. The method **50** includes generating a flow of air **18** at a block **54**. This flow of air **18** is generated in a suitable volume at a suitable pressure to optimize the production of foam according to the permeability of the sock **33** (FIG. **1**). Generally, the flow of air **18** will be contained by a housing **12**, although the housing **12** is not necessary for containing the flow of air **18**. Foam is generated much as bubbles are generated, by directing the flow of air **18** and surfactant fluid **30** through an aperture **39**.

A surfactant fluid **30** is atomized into the flow of air **18** at a block **57**. Again, as will be readily appreciated by those skilled in the art, the ratio between the volume of the flow of air **18** and the atomized surfactant fluid **30** may be changed according to the desired results. At a block **60**, the flow of air **18** and the atomized surfactant fluid **30** are received in a permeable sock **33**. The surfactant fluid **30** flows over the inner surface of the permeable sock **33**. The flow of air **18** generates bubbles, forming a generated foam.

While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. For example, the blower may be located remotely from the nozzle and the sock, allowing the foam to be generated at a site remote from the generation of the flow of air **18**. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims the follow.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An assembly for generating foam, the assembly comprising:

a housing defining a chamber with a first orifice and a second orifice;

a fan arranged within the housing to draw a flow of air into the chamber through the first orifice and to exhaust the flow of air through the second orifice to form an exhausted flow of air;

a nozzle arranged within the chamber and situated in proximity to the second orifice to allow introduction of a fluid into the exhausted flow of air through the second orifice; and

a sock, the sock including a permeable felt textile, the felt textile having an inner surface and an outer surface, and being arranged to occlude the second orifice in a manner to receive the exhausted flow of air with the fluid at the inner surface.

2. The assembly of claim **1**, further comprising a dam arranged within the chamber to influence the exhausted flow of air in a manner to enhance the introduction of the fluid.

3. The assembly of claim **1**, wherein the fan is a squirrel cage blower.

4. The assembly of claim **1**, wherein the fluid is a surfactant, such that the exhausted flow of air is received into the sock to generate a foam at the outer surface.

5. The assembly of claim **1**, wherein the housing includes a shield being arranged to prevent the generated foam from flowing into the first orifice.

6. An assembly for generating foam, the assembly comprising:

a housing defining a chamber with a first orifice and a second orifice, the housing configured to include a shield being arranged to prevent generated foam from flowing into the first orifice;

a fan arranged within the housing to draw a flow of air into the chamber through the first orifice and to exhaust the flow of air through the second orifice to form an exhausted flow of air;

a nozzle arranged within the chamber and situated in proximity to the second orifice to allow introduction of a fluid into the exhausted flow of air through the second orifice; and

a sock, the sock being permeable, having an inner surface and an outer surface, and being arranged to occlude the second orifice in a manner to receive the exhausted flow of air with the fluid at the inner surface.

7. The assembly of claim **6**, further comprising a dam arranged within the chamber to influence the exhausted flow of air in a manner to enhance the introduction of the fluid.

8. The assembly of claim **6**, wherein the fan is a squirrel cage blower.

9. The assembly of claim **6**, wherein the fluid is a surfactant, such that the exhausted flow of air is received into the sock to generate a foam at the outer surface.

10. The assembly of claim **6**, wherein the sock includes a fabric.

11. The assembly of claim **10**, wherein the fabric is a woven textile.

12. The assembly of claim **10**, wherein the fabric is a felt textile.

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