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Anspach, Jr. et al.

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[45] **June 28, 1974**

[54] **APPARATUS FOR PROVIDING CLEAN AIR AT A SURGICAL AREA**

[76] Inventors: **William E. Anspach, Jr.**, 723 Anchorage Dr., North Palm Beach, 33408; **Marinus Bakels**, 1721 Ardley Rd., Juno Isles, both of Fla. 33408

[22] Filed: **Dec. 11, 1972**

[21] Appl. No.: **313,977**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 216,591, Jan. 10, 1972, abandoned.

[52] **U.S. Cl.** ..... **128/132,** 128/1 R, 128/139, 21/74 R, 21/53, 55/DIG. 29, 55/385, 55/418, 55/472

[51] **Int. Cl.** **A61b 19/00**

[58] **Field of Search** ..... 128/132, 139, 187, 1 R; 21/53, 74, 122; 55/DIG. 29, 467, 471, 472, 418, 385

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Primary Examiner—Richard A. Gaudet
Assistant Examiner—Lee S. Cohen
Attorney, Agent, or Firm—Jack N. McCarthy

[57] **ABSTRACT**

This invention relates to both a method and apparatus for providing a laminar flow of clean air through a removal sterile nozzle, having a removable sterile drape therearound, across the surgical area during an operation. The new method constitutes discharging a flow of virtually sterile air at a velocity of between approximately 350 and 800 fpm across the surgical area from a distance of approximately 2 to 5 feet thus producing a barrier zone across the wound surface to prevent contamination from the surrounding air and the surgical team. The apparatus includes a blower, housing, nozzle, drape means, pre-filter means, a pressure plenum, and a High Efficiency Particulate Air Filter (HEPA) capable of discharging, at a velocity of between 350 and 800 fpm, a laminar flow of "clean" air.

12 Claims, 10 Drawing Figures

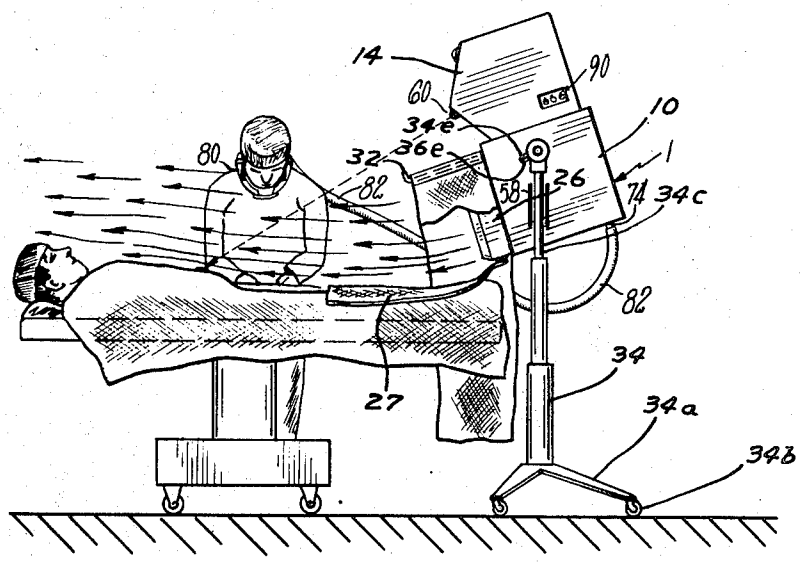
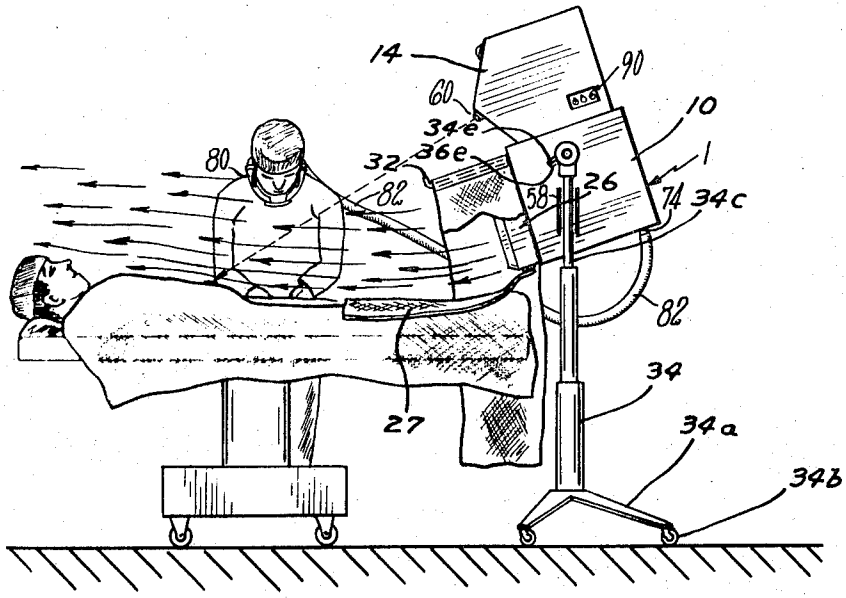


FIG. 1



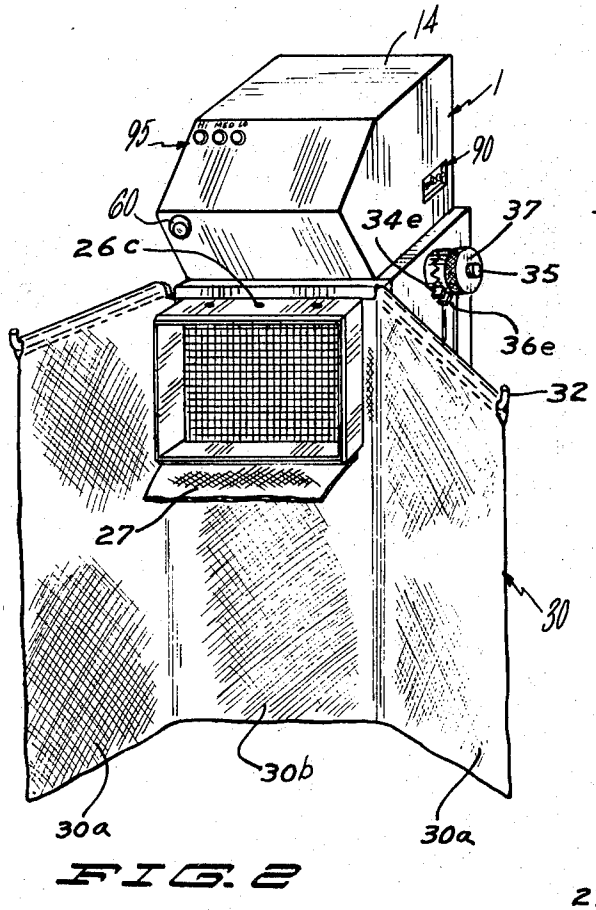


FIG. 2

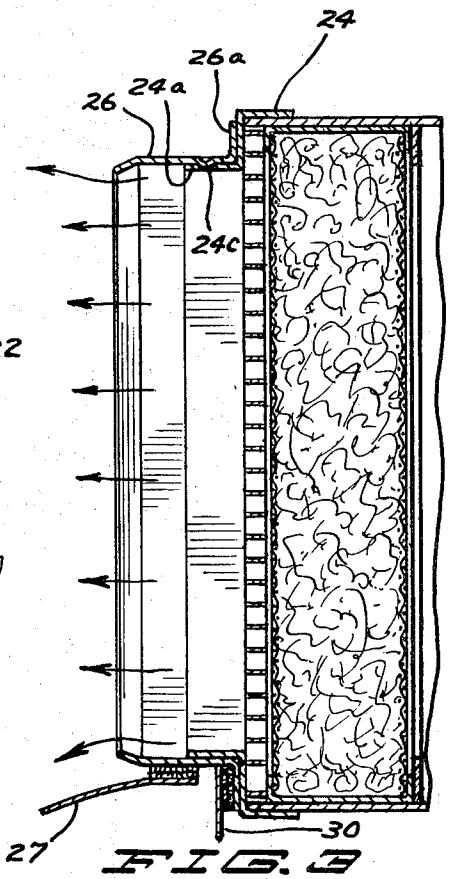
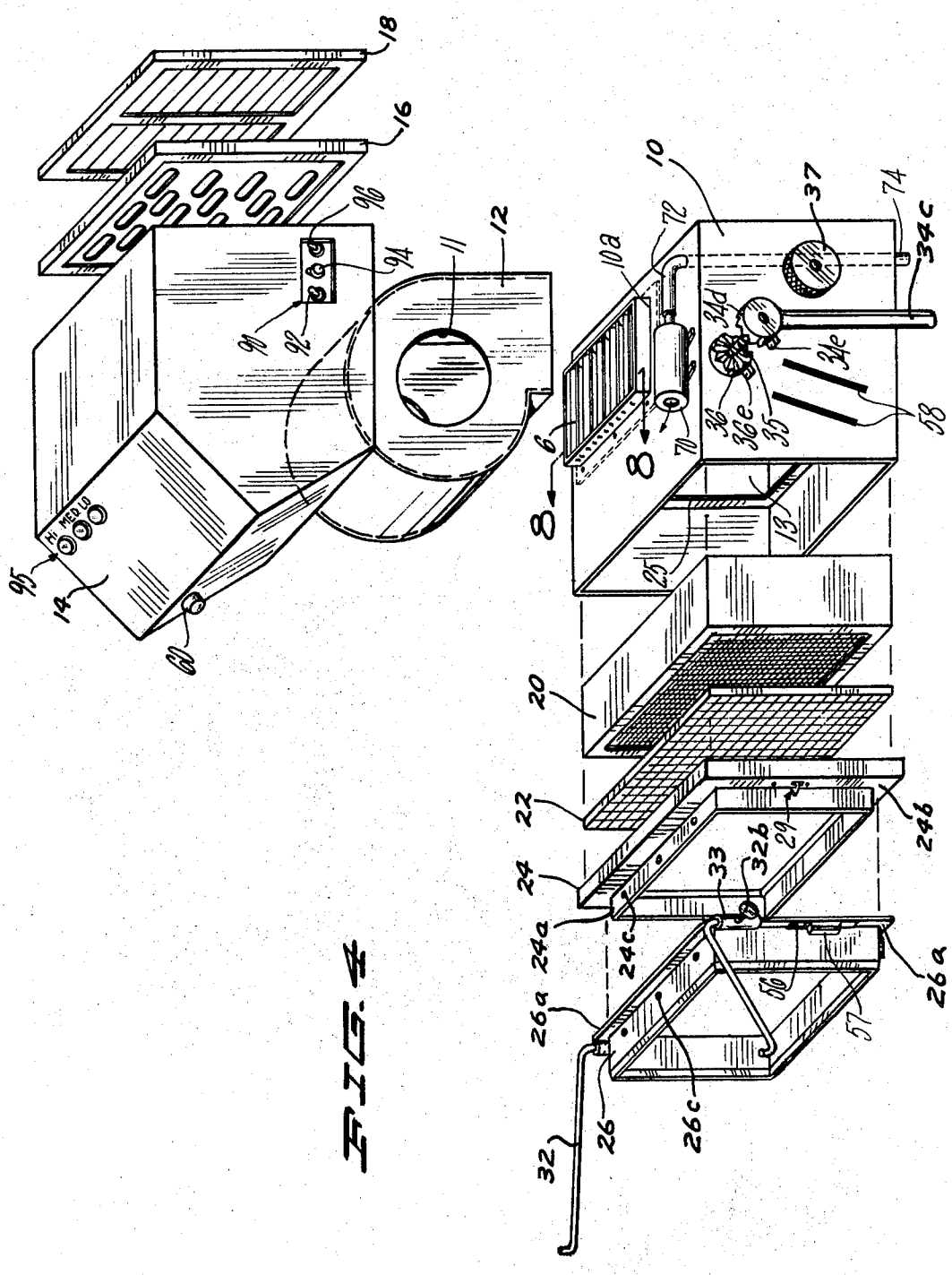


FIG. 3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32b
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24b
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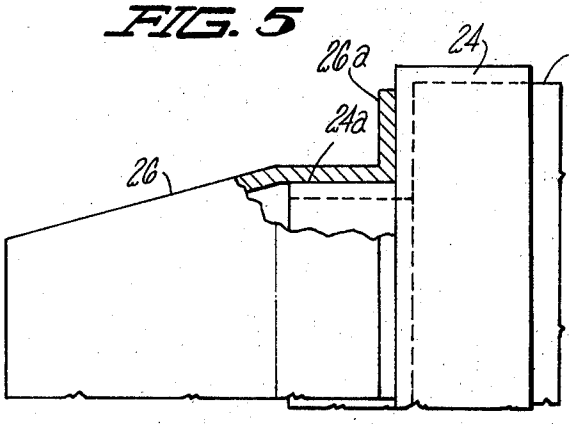
FIG. 4

FIG. 5



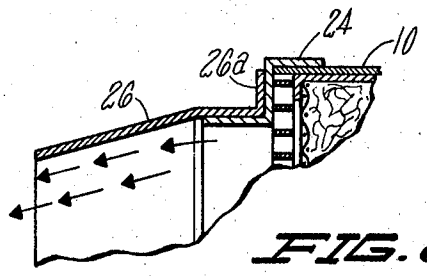


FIG. 6

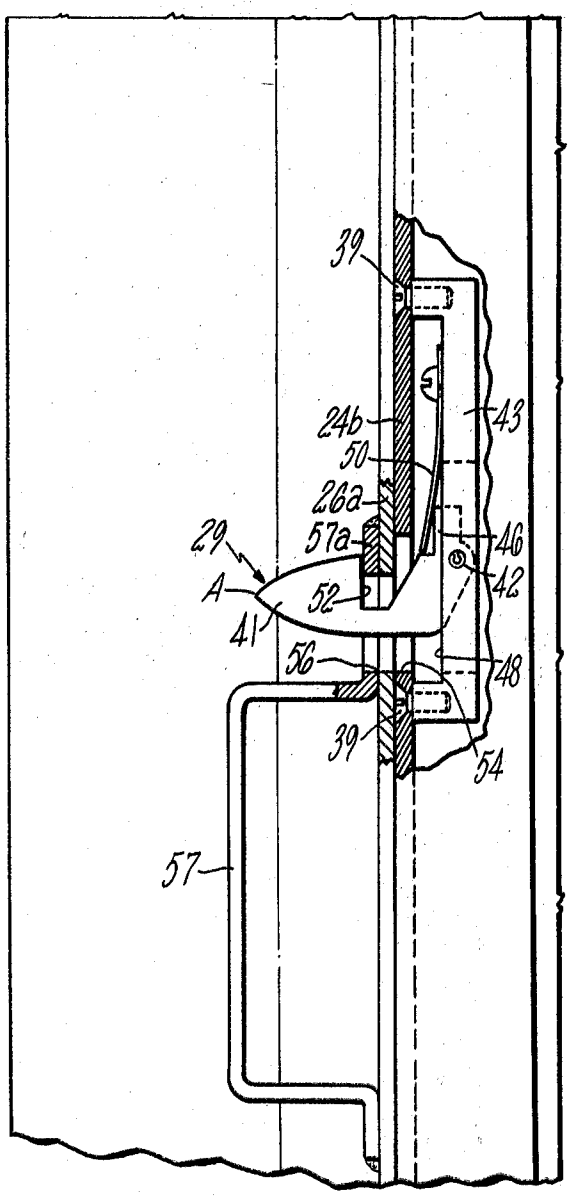


FIG. 7

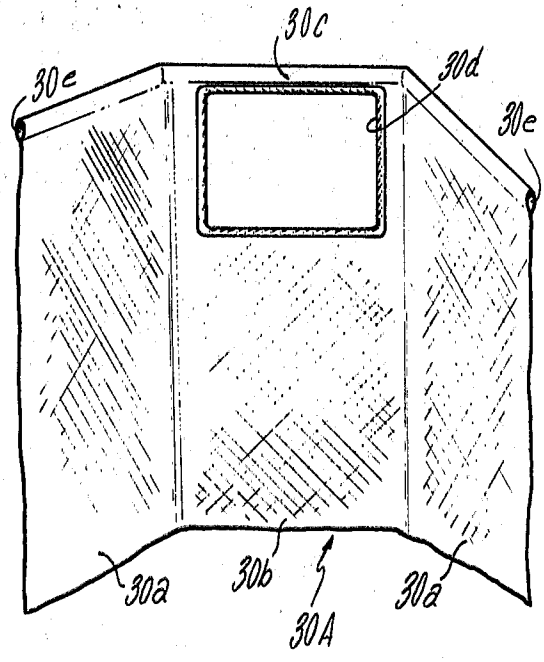


FIG. 8

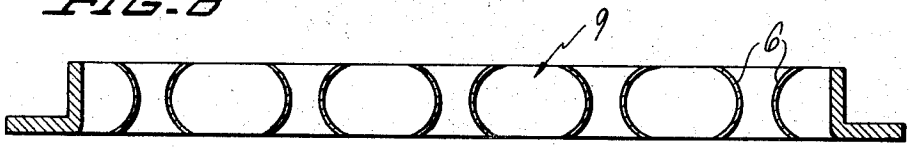


FIG. 9

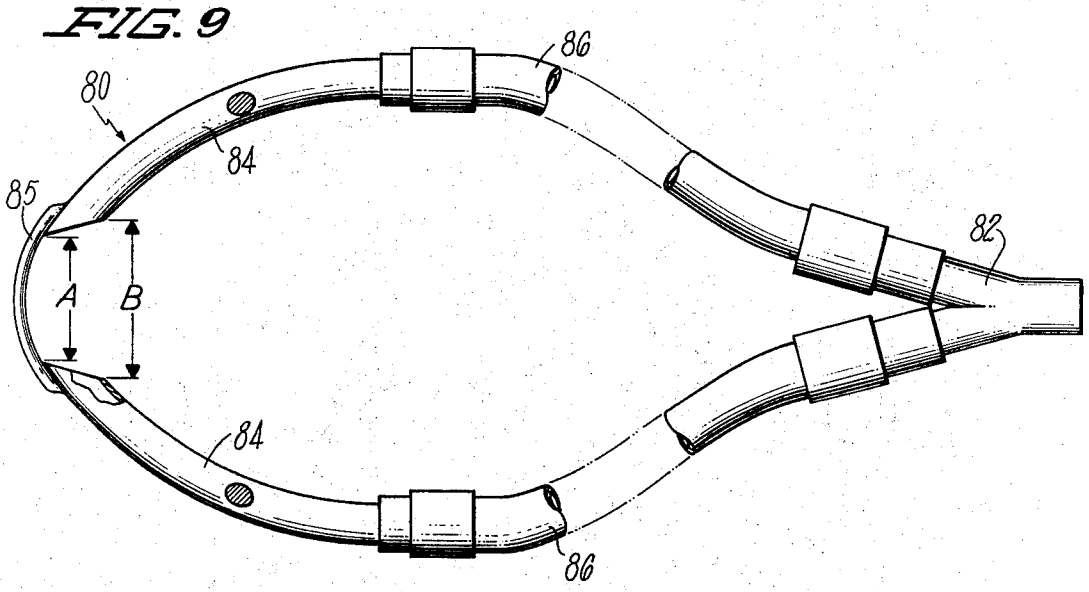
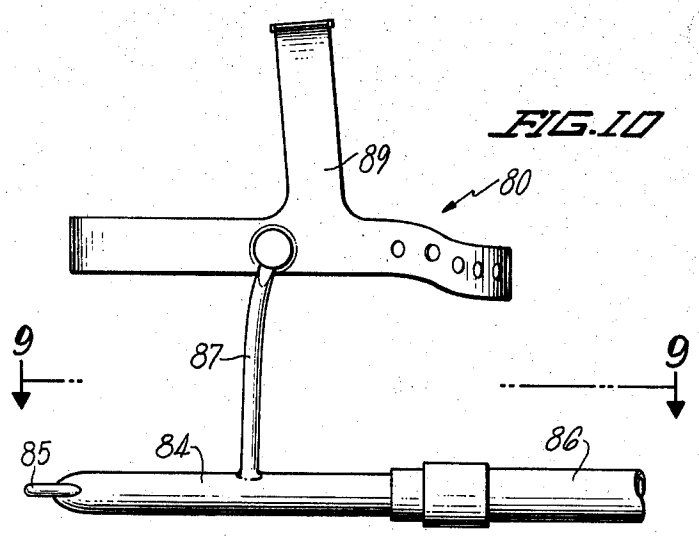


FIG. 10



APPARATUS FOR PROVIDING CLEAN AIR AT A SURGICAL AREA

CROSS REFERENCE TO A RELATED APPLICATION

This is a continuation-in-part of application Ser. No. 216,591, filed Jan. 10, 1972, now abandoned.

BACKGROUND OF THE INVENTION

For approximately the past 10 years considerable work has been done to provide clean air at the site of a surgical operation and various solutions have been developed during this period. Some of these have provided good results but have proved to be cumbersome and expensive. Such a system is disclosed in the Charnley U.S. Pat. No. 3,529,594. The Webb (Inventor Kistko) U.S. Pat. No. 3,385,036 shows a portable clean air discharging unit for producing a filtered low velocity main air stream with a high velocity annular air column which completely surrounds and protects the main air stream. The patent to Thompson et al., U.S. Pat. No. 3,279,883, also shows a system for discharging a main stream of filtered air at a low velocity and providing a protective diverging air screen which prevents the ambient air from being drawn into the low velocity main air stream and contaminating the same.

Our system provides a high velocity laminar flow clean air stream (in the order of from approximately 350 to 800 fpm) which is discharged from an outlet disposed in relatively close proximity to the surgical area (from approximately 2 to 5 feet) and is designed to direct the flow of clean filtered air at an acute angle (between approximately 10° and 45°) to the operating table during an operation to positively prevent contamination by air borne bacteria laden particles frm the breath, face and neck of the surgical team and from the ambient air outside of the clean air stream. It appears that 18° is optimum when the bottom of the nozzle is at wound height.

A number of different tests have been run to establish the effectiveness and criticality of the air velocity and close proximity of the discharge opening to the surgical wound. One series of tests which were run measured the particles in the air which were greater than 0.5 microns in size. It is a recognized scientific fact that particles of less than 2.0 microns in diameter will not support bacteria. Class 100 air has been established as a clean air standard which will minimize the chance of bacterial contamination of the wound at an operative area. Class 100 air is air in which a cubic foot thereof has less than 100 particles having a diameter greater than 0.5 microns. "Clean Air" as used herein is defined as Class 100 air or better. The tests that were run to establish the effectiveness of maintaining a main flow of clean air included operation of the apparatus in a large relatively dirty factory area in which a cubic foot of the ambient air had over 130,000 particles greater than 0.5 microns in size. Under such extreme conditions our apparatus produced Class 100 air (an average of less than 70 particles larger than 0.5 microns in diameter per cubic foot of air) at a distance of 5 feet from the discharge opening with a discharge velocity of approximately 400 fpm. It was also established that the air is considerably cleaner closer to the discharge opening of the machine. This is important because almost all surgical operations can be carried out within three feet of

the discharge nozzle with our apparatus. In a relatively clean room, such as an operating room, where the ambient air averages less than 2,800 particles per cubic foot, our tests using a Coulter 550 particle counter showed the air flow from our machine had an average of less than 7 particles larger than 0.5 microns in diameter per cubic foot at a distance of 5 feet from the discharge opening and a discharge velocity of approximately 400 fpm.

It will be apparent from the foregoing that it is necessary to produce a clean air flow directed across the surgical area in a manner to isolate said area and prevent contamination from the ambient conditions. This is accomplished by providing a protective air blanket traveling at a higher velocity than contaminating particles attempting to penetrate it such as the bacteria laden particles exhaled by the surgical team standing over the wound.

In addition to the particle measuring tests described above, bacterial count testing was also carried out. These tests were run with a Millipore Air Sampling Device with which samples of air were collected from our laminar flow clean air stream at the surgical area and at the same time samples of the ambient air were collected in the operating room outside of said clean air stream. Thereafter the bacteria in the air samples were collected in a broth culture on which standard bacteria tests were run.

With our clean air apparatus located within approximately three feet from the wound site and discharging air at a velocity of approximately 400 fpm, the number of bacteria colonies grown from samples taken at the wound site varied from 0 up to a maximum of 3 and averaged approximately 1.2 colonies per sample while the number of colonies produced from the ambient air varied from 3 to 42 and averaged approximately 20.6 colonies per sample.

Additional tests were run comparing the discharge from the nozzle in a direction parallel with the top of the operating table and our discharge at an angle of at least 10° to the surface of the operating table. The results obtained by the horizontal or parallel discharge were unsatisfactory, however, when the discharge nozzle was elevated above the table top and directed downwardly at an angle of at least 10° the air at the wound site was maintained in a "clean" condition. Also the use of a sterile drape panel which extends between the bottom of the nozzle and the sterilized wound area produced improved particle count and bacteria test results at the wound site. This would seem to indicate that the provision of a sterile drape panel along which the clean air flows to the wound positively prevents entrainment of the contaminating ambient air from below the nozzle and operating table and provides a sterile supporting surface along which the bottom portion of the laminar air flow discharged from the nozzle travels. It is possible that the use of this sterile drape panel between the nozzle and the wound would produce "satisfactory" results even when the discharge angle is less than 10° or even substantially horizontal or parallel to the operating table. Nevertheless, we have found that maintaining at least the 10° angle of discharge does produce improved results regardless of whether or not the drape panel is employed.

SUMMARY OF THE INVENTION

It is a general object to provide an apparatus for pro-

viding a protective flow of clean air traveling at a sufficient velocity at the surgical area to prevent contamination from the surgical team and the ambient conditions.

More specifically, it is an object to provide an apparatus which provides a protective flow of clean air discharged at between 350 and 800 fpm at an angle of between 10° and 45° to the angle of the surface of the operating table from a distance of between 2 and 5 feet from the wound site to prevent contamination of the surgical area during an operation, with 18° being optimum with the bottom of the nozzle at approximately wound height.

Another object of the invention is to have a nozzle which can be easily attached or removed, so that a sterile nozzle can be attached just prior to an operation. A new sterile nozzle is necessary for a specific operation since a member of the operating team may have come in contact with the old nozzle during the previous operation.

A further object of the invention is to provide a drape means for said nozzle which has snug contact with the nozzle and is supported on each side thereof for a short distance to prevent contamination from being drawn from around the housing on which the nozzle is mounted. The center of the drape means curves up and around the operating table from each side to form a seal through that area.

Another object is to provide a quick attach-detach mechanism which permits alignment of the nozzle and positive locking with a minimum of time and effort. This is necessary to prevent a member of the operating team attaching a nozzle from becoming contaminated by the remainder of the housing and prevents the nozzle from dropping off during the operation and possibly hitting the patient.

A further object of the invention is to provide an indicating means on the device to show a desired angular position of the housing.

A further object of the invention is to provide an easily adjustable stand so that the device can be positioned at a desired height with a minimum of effort such as positioning the bottom of the nozzle at approximately wound height for an operation.

Another object of the invention is to provide an aiming light which indicates to the surgeon, when the housing is directed towards the wound and positioned at its proper angle to the operating table and the bottom of the nozzle is approximately at wound height, that he is working in a sterile area when the light is at or distal to the wound.

A further object of the invention is to provide a laminar flow from a clean air apparatus which will have substantially the same flow at all points at a discharge plane.

These and other objects and advantages of this invention will be apparent from the following description made in connection with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views, and in which:

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view showing the clean air producing apparatus in operative position at the foot of an operating table;

FIG. **2** is a front perspective view of the apparatus shown in FIG. **1**;

FIG. **3** is a fragmentary central vertical sectional view showing the discharge opening and the easily removable nozzle;

FIG. **4** is an exploded perspective view showing the parts and arrangement thereof in said apparatus;

FIG. **5** is a view of the nozzle and housing member broken away to show the latching means;

FIG. **6** is a fragmentary sectional view showing a modification of the nozzle;

FIG. **7** is a modification of the draped panel for connection to arms on the apparatus;

FIG. **8** is a sectional view of the equalizer showing the vanes and their arrangement;

FIG. **9** is a top view of the bottom portion of the head device; and

FIG. **10** is a side view of the head device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in the accompanying drawings, the clean air apparatus **1** includes a lower housing member **10** having an inlet opening **10***a* in the upper rear portion thereof. Said inlet opening has a pressure equalizer **9** therein to be hereinafter described. A blower **12** (schematically shown) having side inlets **11** is mounted on said housing member **10** and discharges downwardly through said pressure equalizer **9** in opening **10***a* into the rear portion of a pressure plenum chamber **13** defined within the rear portion of said lower housing member **10.** An upper housing member **14** fixed to the housing member **10** surrounds the blower **12** and is provided at the rear with a preliminary filtering element **16.** A decorative grill **18** covers and protects the outer face of the filter element **16** and is fixed to the upper housing member **14** holding the filter **16** in place. A High Efficiency Particulate Air (HEPA) filter **20,** well known in the trade, is mounted across the front of the lower housing member **10** and the air discharged downwardly from the blower **12** passes through the pressure equalizer **9,** the plenum chamber **13,** the HEPA filter **20** which produces and discharges a laminar flow of air, which then passes through a grill **22** and a discharge opening defined by a rectangular nozzle mounting flange **24***a* which is carried by a frame member **24** which in turn is secured over the front of the housing member **10.** The nozzle mounting flange **24***a* is slightly smaller in size than the outer frame **24** and a suitable peripheral facing panel **24***b* connects the flange and frame members together. Panel **24***b* holds the grill **22** and filter **20** in place against a flange **25** around the inner surface of the housing member **10.**

A sterilizable nozzle **26** is mounted for quick and easy removal on the flange **24***a* in a manner to permit said nozzle to be completely sterilized. In the form shown, the nozzle **26** has a peripheral attachment face plate **26***a* which is positively held in face-to-face relation with the facing panel **24***b*. While any means can be used, such as a pair of attachment screws, a pair of novel quick attach-detach latching means **29** are preferred. The latching means are located on each side section of the panel **24***b* at a point approximately midway of its ends.

Each latching means **29** comprises a lever **41** which is pivoted on a pin **42.** Each pin **42** is mounted a short distance rearwardly of the panel **24***b* by a support bracket **43.** Bracket **43** is formed as a U-shaped member with its ends fixed to the rear of the cooperating

part of panel 24*b*. While the ends can be fixed by any means desired, the means shown are screws **39**. The lever **41** extends forwardly below the pin **42**. A short lever **46** extends upwardly from the pivoted end of lever **41**. The top of the lever **41** extends forwardly of the lever **46** along a line which, if extended, would be adjacent the center of the pin **42**. Said forward face of said upstanding lever **46** meets said top of the lever **41** forwardly of the face **48** of the bracket **43**. A leaf spring **50** has one end fixed to the face **48** above the lever **41**, while its other end extends along the forward face of lever **46** to a point which is at the top of the lever **41**. With the upper end of the leaf spring fixed in place, the lower end of the spring holds the lever **41** in its uppermost position, extending forwardly substantially as shown in FIG. **5**. This spring **50** acts with upstanding lever **46** to bias lever **41** upwardly to a position wherein the top of the lever **41** contacts the end of the spring which acts as a stop. A latching means **29** in its mounted position has its lever **41** projecting through an opening **54** in the panel 24*b*.

As the lever **41** is forced downwardly, the top of the lever **46** is forced against leaf spring **50** bending the free end forwardly towards the back of the panel 24*b*, thereby placing a biasing force on the lever **41** to return it to its upward position. A notch **52** is formed in the top edge of the lever **41** to engage the nozzle **26** in a manner to be hereinafter described.

The forward part of the lever **41** tapers inwardly on all four sides to form a small point A at the tip thereof. This shape enables the lever **41** to easily enter an opening **56** in the attachment face plate 26*a* of the nozzle. Each opening for a respective latch means **29** is formed at substantially midway of the side section of the attachment face plate 26*a*. A handle **57** is fixed to each side section of the forward face of the attachment face plate 26*a* by an upper and lower flange. Each handle **57** is located below its cooperating opening **56** and the upper flange 57*a* extends to a point above its cooperating opening **56** with each opening **56** extending through the upper flange of the cooperating handle **57**. The nozzle **26** is held by the handles **57** with each hand with a thumb free and extending over each handle to engage the free ends of the forward parts of the levers **41**, when necessary. The notch **52** must accommodate the thickness of the panel 26*a* and upper flange 57*a*. Each opening **56** has its top edge located so that as the nozzle is guided over the mounting flange 24*a*, it strikes the forward end of the lever **41** just above point A, camming it downwardly against the spring **50** until it reaches the notch **52** wherein the spring **50** pushes the lever **41** upwardly in place (see FIG. **5**) to axially restrain the nozzle from being removed or accidentally falling off.

It can be seen that with the configuration of lever **41**, as the nozzle is pulled straight out from the latching means **29**, the lever **41** is, in effect, given a rotation upwardly, thereby keeping the latch closed. The nozzle is removed by pressing downwardly with one's thumb on the projecting forward ends of the lever **41**. This permits the nozzle to be withdrawn forwardly from the mounting flange 24*a*. As the nozzle is removed, the levers **41** are biased back to their upward position by spring **50**.

Auxiliary retaining means may also be provided such as the plurality of downwardly extending projections 26*c* provided on the bottom surfaces of the top cross bar of nozzle **26**. These projections are received in cooperating recesses or apertures 24*c* provided in the top cross member of flange 24*a*.

The forward marginal edge portions of said nozzle **26** are beveled inwardly to form a restricted discharge opening which produces a venturi action which surrounds and protects the main air streams discharged through the nozzle and acts as a buffer to restrict or prevent entrainment of the outside contaminating ambient air. Two modifications are shown in FIGS. **3** and **6**. The modification shown in FIG. **6** is the preferred form.

A sterilized surgical drape panel or operating sheet **27** can be attached along the lower cross member of nozzle **26** by any suitable means such as the mating strips of Velcro respectively attached to the lower nozzle cross member and the marginal edge portion of the end of drape panel or operating sheet **27**. The mating Velcro strips serve to provide a seal between the end of the surgical drape and the nozzle and this seal positively prevents entrainment of the ambient air from below the nozzle. This drape panel **27** when used, extends from the nozzle to the wound area and provides a sterile surface over which the clean air stream travels. A second drape panel **30** having laterally extending side panels 30*a* and integral bottom panel 30*b* is also provided to surround the sides and bottom of the nozzle **26** as best shown in FIG. **2** and restricts entrainment of the contaminating ambient air into the clean air stream. Velcro strips are also provided for attaching the lower and side attachment portions of the drape **30** to the bottom and sides of the peripheral face plate 26*a*. The use of drape panel **30** alone is preferred with the bottom panel 30*b* placed over the patient such as the drape panel **27** is shown in FIG. **1**. A pair of laterally extending arms **32** are provided to engage the top of the side panels 30*a*. Suitable sleeves **33** are respectively attached to the upper side portions of nozzle **26** to provide support for the arms **32** and set screws 32*b* can hold said arms in a desired angular relation if necessary. A simple friction-held pivotal connection can be used if desired.

Suitable means for supporting the entire unit are provided and in the form shown, this constitutes an adjustable stand **34** having a floor-supported adjustable base 34*a* with conductive caster wheels 34*b*. A mounting yoke 34*c* is provided at the top of the stand and a pair of mounting bosses 34*d* are respectively provided at the top of the two arms of the yoke 34*c*. A pair of threaded mounting pins **35** are respectively fixed to the side panels of the housing member **10** and a boss **36** also fixed to each of the side panels surrounds the base of each pin **35**. While the mounting pins **35** and bosses **36** are shown fixed to the side panels of the housing member **10**, they can be fixed to the sides of the upper housing member **14**. The position can be determined by the weight distribution of the clean air apparatus **1**. For ease in adjustability, it is desirable to have the larger part of the weight below the mounting pins **35** and bosses **36**. The bosses 34*d* and **36** on each side of the housing have toothed adjusting mating surfaces to permit the angle of discharge to be adjusted and locked in the desired adjusted position. Suitable threaded locking knobs **37** are provided for releasably locking the two bosses together on each side of the housing member **10**. While the knob **37** has been shown as knurled on its outer edge, it can be provided with arms extending radially therefrom (not shown) for ease of rotation. Since

the minimum angle of discharge has been found to be critical, when the clean air apparatus is being used at an operating table during an operation, a pair of indicating lines **58** have been placed on the side panels of the housing member **10** so that an arm of the yoke **34***c* can be placed therebetween and have the nozzle directed downwardly at a desired angle. This angle has been determined to be 18° when the bottom of the nozzle is at the height of the wound and the clean air apparatus **1** is from approximately 2 to 5 feet from the wound. If desired, a pair of positive stop elements **34***e* and **36***e* can be mounted, respectively, on bosses **34***d* and **36** to positively limit the lower angular position of the nozzle.

An adjustable aiming light **60** is provided on the forward face of the upper housing member **14** of the clean air apparatus **1** to be used with the indicating lines **58** to indicate proper angular positioning of the nozzle during an operation. When the indicating lines are set at 18°, the aiming light **60** is so angularly positioned and fixed on the face of the upper housing member **14** so that when the yoke **34***c* is placed between the indicating lines **58** placing the nozzle **26** of the apparatus **1** at a downward angle of 18°, with the bottom of the peripheral face plate **26***a* of the nozzle at wound height, the light beam should intersect the patient at approximately 42 inches from the nozzle. Therefore, the surgeon should see the light at a point away from the wound, placing the wound between the intersecting point and the nozzle **26** of the clean air apparatus **1**; this would place the wound in the best possible area for contamination-free operation.

If other angular positions of the nozzle **26** of the clean air apparatus **1** are found to be advantageous for other uses of the apparatus, then the indicating lines **58** can be placed thereon indicating other degrees of angularity in aiming. The aiming light **60** can also be reset so that it can be used in conjunction with the new angular position to convey to someone that the proper position exists.

The drape and nozzle assembly may be sterilized as a single unit if desired and the entire sterile assembly including the drape panels **27** and **30** can be mounted on the nozzle **26** and securely attached thereto as described. The drape panels **27** and **30** and nozzle **26** can also be made disposable. As has been previously stated, the lower drape panel is designed to extend from the sterile nozzle **26** to the wound area to positively prevent entrainment of air from below the nozzle into the clean air stream and also provide a sterile surface over which the air travels to the wound area. The side drape panels **30***a* mounted on arms **32** are designed to prevent entrainment of the contaminated air along the sides of the laminar clean air flow discharged through the nozzle **26.**

However, it is not necessary to use the drape panel or operating sheet **27**; the center of the drape panel **30,** bottom panel **30***b*, can be placed over the bottom of the operating table thereby achieving the result of having a sterile surface extending from the nozzle to the operating table and also restricting entrainment of the contaminating ambient air from around the bottom or sides of the clean air apparatus into the clean air stream.

A modification of the drape panel **30** is shown in FIG. **7.** This drape panel **30A** has a connecting top portion **30***c* which forms an opening **30***d*. The edge of opening **30***d* is formed having elasticity so that with the opening **30***d* smaller than the outer periphery of the peripheral face plate **26***a* of the nozzle it is held against the face plate **26***a* forming a sealing engagement. This edge can be formed, for example, of rubber cord or be a coil spring mounted in a sewn-in channel. The arms **32** extend into the sewn-in channels **30***e* through openings in the back of the drape panel **30A**, such as in drape panel **30.**

The air discharged downwardly from the blower **12** passes through the pressure equalizer **9** into the pressure plenum chamber **13** defined by the rear portion of the housing member **10** which produces a discharge flow through the HEPA filter **20** which has substantially the same flow at all points across its discharge plane. This condition is obtained in the pressure plenum chamber **13** by the use of the pressure equalizer **9** (see FIGS. **4** and **8**). This device is located between the exit of the blower **12** and the chamber **13** and is constructed having 10 vanes **6,** which are spaced equally apart at their edges a distance of approximately 1 inch. The vanes **6** each have a ½-inch radius and are placed in a manner so that the end vanes have their concave surface facing the end wall of the opening while vanes located therebetween have their surfaces alternately spaced along the length of the equalizer. The vanes have a chord length of seven-eighths of an inch. This creates an equalized pressure across the rear of the HEPA filter so that air exiting the filter approaches true laminar flow. It will be noted that the width of the clean air flow is substantially equal to the width of the operating table so that the surgeon and the operating team will not be standing in the clean air stream but the clean air stream will prevent the wound area from being contaminated by the surgical team and the ambient air.

A suction forming device **70** is fixed on top of the housing member **10,** being positioned between the blower **12** and sides of the upper housing member **14** when it is in place. The device **70** is connected by a flexible plate **72** through plenum chamber **13** to a connector **74** located projecting from the bottom of the housing member **10.** Depending on the use of the clean air apparatus, one or more of the connectors can be made available. In the device shown (see FIG. **1**), the operating surgeon has a head device **80** thereon which has a flexible tube **82** connected to the connector **74.** This permits the surgeon's breath to be drawn away from the area over the wound to prevent any contamination from this source. This air is drawn in by the suction device **70** into the area within the upper housing member **14** and then directed into the blower **12** where it is passed through the HEPA filter **20,** removing air borne bacteria, before again entering the operating room.

The head device **80** comprises two arcuate metal tubes **84** contoured to pass around the cheek portions of the face with the forward ends threof ending adjacent to the corners of the mouth. The forward edges of the tubes are connected by a metallic member **85** and are spaced approximately 2½ inches apart at A, while the rear edges are spaced approximately 2¾ inches apart at B. This construction permits a high percentage of the surgeon's breath to be drawn off by the suction device **70.** A tubular member **86** connects each of the rear ends of the members **84** to a Y-shaped end on the member **82.** The arcuate metal tubes **84** have metal rods **87** fixed thereto extending upwardly therefrom

which are pivotally connected at the upper end to a headgear **89** which is adjustable to fit on a surgeon's head.

While electrical circuitry is not shown, an operating panel **90** is shown on the side of the upper housing member **14.** This panel includes an aiming light switch **92,** a rotary switch **94** controlling blower speed, and a switch **96** for the suction forming device **70.** Indicating lights **95** on the forward part of upper housing **14** permit the operating team to know at all times at what speed the blower is operating.

It will be seen that we have provided a relatively simple, yet highly effective method and apparatus for materially improving the bacteriologic conditions around the wound area to materially reduce the possibility of infections through contamination during a surgical operation.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportion of the parts without departing from the scope of the invention, which generally stated, consists in the matters set forth in the accompanying claims.

We claim:

1. In a device providing clean air flow, a housing containing a first and a second chamber, said second chamber containing a discharge opening for directing a flow of air therefrom, means for filtering said air flowing from said second chamber through said discharge opening, said first chamber having an inlet opening for receiving air surrounding said device, opening means between said first and second chambers, means for forcing said air from said first chamber through said opening means to said second chamber and through said discharge opening so that the velocity of the air through said discharge opening is sufficient to prevent entrainment of the surrounding air and produce a clean air zone in front of said discharge opening, means for supporting said housing so that it can be easily positioned at different heights and at different angles therewith so as to position a clean air zone where desired, nozzle means for extending and maintaining a clean air zone, means connecting said nozzle means to said housing around said discharge opening so that it can be easily attached or detached, said nozzle means extending outwardly from said housing, arms extending outwardly from each side of said nozzle means, a surgical drape connected to said arms and hanging down therefrom, said drape having a cut-out portion through which said nozzle means extends, said drape being held tightly against said nozzle means around said cut-out portion providing a sterilized barrier preventing air from around the housing being drawn into the air directed out the discharge opening and nozzle means.

2. A device as set forth in claim **1** wherein said drape has elastic means around the edge of said cut-out portion to hold said drape tightly against said nozzle means.

3. A device as set forth in claim **1** wherein said connecting means includes a flange extending outwardly from the housing around the discharge opening, said nozzle having a second inlet opening slidably engaging said flange, said connecting means including a quick attach-detach latch means for preventing said nozzle means from sliding off of said flange on said housing during use while permitting quick release when necessary.

4. A device as set forth in claim **1** including an aiming light for indicating the desired usable extent of a clean air zone from the nozzle means, said aiming light being located on said housing above said nozzle means and placed at an angle thereto so that an aiming beam from said aiming light intersects a clean air zone at the desired usable extent, and means for energizing said aiming light.

5. A device as set forth in claim **1** wherein said opening means between said first and second chambers includes a pressure equalizer for equalizing the pressure in said second chamber adjacent the means for filtering said air flow from said second chamber, said pressure equalizer comprising a plurality of vanes positioned across said opening means, each vane being curved along its length thereby having a concave surface, said vanes being positioned so that alternate vanes have their concave surface facing in opposite directions, the edges of said vanes being spaced equally apart across the opening means.

6. A device providing clean air flow set forth in claim **1** including means for filtering air entering said inlet opening into said first chamber.

7. A device providing clean air flow set forth in claim **1** wherein said supporting means includes a yoke having an upstanding arm on each side of said housing, indicating lines positioned on the side of the housing to align an arm therewith to indicate angular position of the housing and discharge opening.

8. In a device providing clean air flow, a housing containing a first and a second chamber, said second chamber containing a discharge opening for directing a flow of air therefrom, means for filtering said air flowing from said second chamber through said discharge opening, said first chamber having an inlet opening for receiving air surrounding said device, opening means between said first and second chambers, means for forcing said air from said first chamber through said opening means to said second chamber and through said discharge opening so that the velocity of the air through said discharge opening is sufficient to prevent entrainment of the surrounding air and produce a clean air zone in front of said discharge opening, means for supporting said housing so that it can be easily positioned at different heights and at different angles therewith so as to position a clean air zone where desired, nozzle means connected to said housing around said discharge opening for extending and maintaining a clean air zone, an aiming light for indicating the desired usable extent of a clean air zone from the nozzle means, said aiming light being located on said housing above said nozzle means and placed at an angle thereto so that an aiming beam from said aiming light intersects a clean air zone at the desired usable extent, and means for energizing said aiming light.

9. In a device providing clean air flow, a housing containing a first and a second chamber, said second chamber containing a discharge opening for directing a flow of air therefrom, means for filtering said air flowing from said second chamber through said discharge opening, said first chamber having an inlet opening for receiving air surrounding said device, opening means between said first and second chambers, means for forcing said air from said first chamber through said opening means to said second chamber and through said discharge opening so that the velocity of the air through said discharge opening is sufficient to prevent

entrainment of the surrounding air and produce a clean air zone in front of said discharge opening, means for supporting said housing so that it can be easily positioned at different heights and at different angles therewith so as to position a clean air zone where desired, nozzle means connected to said housing around said discharge opening for extending and maintaining a clean air zone, said opening means between said first and second chambers including a pressure equalizer for equalizing the pressure in said second chamber adjacent the means for filtering said air flow from said second chamber, said pressure equalizer comprising a plurality of vanes positioned across said opening means, each vane being curved along its length thereby having a concave surface, said vanes being positioned so that alternate vanes have their concave surface facing in opposite directions, the edges of said vanes being spaced equally apart across the opening means.

10. A device as set forth in claim **9** wherein each vane has a chord length of approximately seven-eighths of an inch, the concave surface having approximately a ½ inch radius, and said edges being spaced about a distance of approximately 1 inch.

11. A device as set forth in claim **9** including an aiming light for indicating the desired usable extent of a clean air zone from the nozzle means, said aiming light being located on said housing above said nozzle means and placed at an angle thereto so that an aiming beam from said aiming light intersects a clean air zone at the desired usable extent, and means for energizing said aiming light.

12. A device providing clean air flow set forth in claim **9** wherein a suction forming device is located in said first chamber, a connector projecting from said housing whereby an accessory can be attached needing a suction applied thereto, pipe means connecting said suction forming device to said connector, said suction forming device discharging into said first chamber adjacent said opening means.

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