An operating mask for protection of the operator from airborne bacteria and viruses during dental operations. One form of mask includes a cup which encloses at least the nose, mouth, and chin areas of the face of the wearer and which is made of a rigid material, with a peripheral gasket secured to it. The mask is carried by a headband, and use of the gasket and adjustment of the headband permit an air-tight chamber to be formed. The mask also includes air inlet means and exhaust means so that purified air can be forced into the chamber formed by the cup, while contaminated air can be evacuated completely away from the atmosphere in which the operation takes place. Communication means are also provided as well as means for protecting the hearing of the user. Protection of the eyes from trauma and infection and aids for sharper visualization and protection of visual acuity are also provided. In the preferred form of the invention, the entire face is enclosed, but it is possible to utilize the general principles of the invention with variations in which only the nose, mouth, and chain areas of the user are enclosed in the airtight chamber. A still further variation permits the use of a complete head-enclosing helmet which is sealed over the shoulders in a manner comparable to football shoulder pads or by means of a cuffed suit or tunic.
BACTERIAL CONTROL MASK

BACKGROUND OF THE INVENTION

This invention, in general, relates to sanitary devices and, in particular, relates to a mask which can be used by a dentist and/or a dental assistant during dental operations to permit the operation to be accomplished without exposing the dentist or dental assistant to bacteria or viruses carried by the patient and, similarly, to protect the patient from bacteria or viruses carried by the assistant or the dentist. In this regard, the respiratory system represents the most severe source of cross-contamination, and the principle of this invention is a complete and total control of the operator’s respiratory system without any communication with the immediate surroundings.

DESCRIPTION OF THE PRIOR ART

Considering the environment involved here, perhaps the most pertinent prior art is applicant’s earlier U.S. Pat. No. 3,528,415 which discloses a mask which can be used by dentists to protect both him and the patient from contamination by bacteria during use.

While the mask of that patent has proved to be acceptable in practice, it has been found that improvements can be made. Specifically, the mask shown in U.S. Pat. No. 3,528,415 relies upon the use of filter means and filter materials in the nose/mouth area. While this is, as noted above, satisfactory in general, it is theoretically, however, deficient in that a perfect filter would not permit bacteria or viruses to pass, but also would not permit passage of air. Therefore, in practice, the particular filter utilized has to have a certain porosity in order to permit the user to breathe, and this, of course, immediately negates the possibility of a completely bacteria-free situation.

The present invention represents an improvement over the mask of U.S. Pat. No. 3,528,415 in that it does provide a complete protection against contamination.

DESCRIPTION OF THE INVENTION

It is well known, of course, that any person, be he patient, dentist, or dental assistant, will expire a certain amount of bacteria and virus into the atmosphere during normal breathing. The dangers of this phenomena are magnified in dental operations because the patient, dentist and the dental assistant are in extremely close contact with each other, and particularly their faces are in a very narrow, restricted area so that a transfer of bacteria, etc., becomes inevitable. This is even more so today with the advent of air turbine hand pieces and ultrasonic tooth-cleaning devices which produce a large amount of aerosols to thus magnify the contamination threat.

It has been found that by providing a mask which provides and air-tight seal around the nose, mouth, and chin areas of the user and further, by providing this mask with means for introducing purified air into the air-tight chamber and exhausting expired air therefrom, the risk of contamination and the above problems can be obviated.

This is particularly true when the means for exhausting expired air from the chamber are connected to an atmosphere completely outside of the operating area, such as out of the room or into a purifying means such as conventional ultraviolet or infrared filters.

It has also been found that a mask of this type can be provided with magnifying means to facilitate the job of the dentist. The mask can also be mounted on an adjustable headstrap so as to fit virtually any size head while retaining the mask in air-tight communication with the face.

It has also been found that a mask of this nature can be provided with ear obturators or protective devices such as ear cups of any one of a number of conventional structures such as, for example, are disclosed in applicant’s earlier U.S. Pat. No. 3,528,415.

It has also been found that communication means can be carried by the body of the mask to permit the wearer to communicate.

Accordingly, production of an improved mask in the nature described becomes the principal object of this invention, with other objects thereof becoming more apparent upon a reading of the following brief specification and claims considered and interpreted in view of the accompanying drawings.

Of the drawings:

FIG. 1 is a perspective view of one form of the mask.
FIG. 2 is a perspective view showing a modified form of the mask.
FIG. 3 is a front elevational view showing still another modified form of the mask.
FIG. 4 is a front elevational view showing a third modified form of the invention mounted on a wearer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Considering first FIG. 1, it will be noted that the mask, generally indicated by the numeral 10, includes a mask body 11 which is contoured so as to fit over the frontal part of the head of the wearer. This face plate 11 has an eye shield 12 which is clear and which is located so as to permit unobstructed vision by the wearer.

The face plate 11 also has a gasket 13 around its periphery which permits an air-tight chamber to be formed about the face of the user once the mask is in position and is properly adjusted.

Mounted on the face plate 11 are headbands 14 and 16, with these headbands being adjustable by means of the nuts 15 and 17. The headband structure has not been described or illustrated in any great detail herein since there are a number of adjustable headbands conventionally available, and most of them would be suitable.

Also carried by the headband are ear covering members 18, 18 which again can be of any one of a number of types and are intended to protect the hearing of the wearer from obnoxious sounds, such as would be generated by high-speed drills, etc.

Turning again to the face plate 11, it will be noted that this plate has a magnifying member 20 which consists of a framework having a magnifying glass in its central portion 21 and being pivotally secured to the sides of the face plate at 22, 22. This permits the magnifying means to be raised when it is not in use or to be dropped into position covering the eye shield 12 when desired.

The face plate 11 also carries air inlet and exhaust tubes 30 and 31. These tubes are mounted on the face plate at 30a and 31a and held to the face plate by clamps 33, 34, and they include control valves of a conventional nature (shown schematically) for controlling
the intake and exhaust of air to insure comfort to the wearer.

It should be noted in FIG. 1 that the tubes 30 and 31 would appear to hang down in front of the user. This
has been done only for purposes of illustration, and it
it is contemplated in use that they would be draped over
the shoulders of the wearer and down his back and then
passed back to the front at about waist level and se-
cured to the body so that the point of connection with
the tubes or hoses leading to the air source and vacuum
source are readily accessible while tubes 30 and 31 are
out of the way and do not interfere with the dental op-
eration. The tubes are also foreshortened for illustra-
tion purposes.

It should also be noted that the intake tube 30 is
mounted so that the incoming air will be directed in the
general direction of the wearer’s nose and mouth with
exhaust tube 31 being mounted above it to pull the in-
coming air across the nose-mouth area. A side-by-side
arrangement such as is shown in FIGS. 2, 3 and 4 is also
possible, but again, it is desirable to have the exhaust
hose mounted at least slightly above the intake tube to
facilitate passage of the air over the nose-mouth area.

Exhaust tube 31 has a quick-disconnect linkage 31a
which permits it to be snapped into a tube (not shown)
leading in the direction of the arrow 61 to a vacuum
source which is shown only schematically.

Similarly, air intake tube 30 has a quick-disconnect
coupling unit 30b on its end, and this is connected to
another tube which leads from an air source in the di-
rection of arrow 60. The air source again is shown only
schematically herein.

Tubes 30 and 31 also carry valves 30c and 31c which
permit the wearer to control air intake and exhaust for
purposes of comfort. These valves are intended to be
of a conventional type and are only shown schemati-
cally herein. Preferably, they would be located adja-
cent the point of connection with the hoses leading to
the air and vacuum source for ready access by the
wearer.

The mask of FIG. 1 also carries communication
means 40 which is a small microphone mounted inside
the face mask, as is shown in FIG. 1, with the corre-
sponding wire 41 and jack 42 leading to an amplifier
and speaker which would be located externally in the
operating room. In order to avoid interference with the
operation, this wire 41 is carried on the tube 30 so as
to minimize the number of appendages dangling from
the mask.

Alternatively, the microphone 40 could be replaced
by a transistorized transmitter, in which event a re-
ceiver amplifier would be located somewhere in the
operating room. This enables the wearer to communicate
with others in the room.

If ear pieces 18, 18 are substantially sound proof, it
may be necessary to place regular ear type receivers
18c in one or both of them. Receivers of this nature are
well known in the radio art and are only shown sche-
matically herein.

In use or operation, of course, the mask is simply
placed on the head of the wearer, with the bands 14
and 16 being adjusted, and then it is merely necessary
to activate the air source and the vacuum source to en-
sure a continuous flow of purified air to the chamber
formed by the mask.

Turning next then to FIG. 2 for a modified form
of the invention, it will be noted that the mask is generally
indicated by the numeral 100. In this form of the inven-
tion, only the nose and mouth of the wearer are sealed
off.

Thus, a face plate 111 of clear, rigid material, such
as plastic, is provided, with the face plate being con-
toured to fit about the face of the user. A magnifying
means 120 is pivotally mounted on this face plate and
has the usual magnifying lens 121 similar to that shown
in FIG. 1. Similarly, the head-band construction 114,
115, 117, and 116 is identical to that of FIG. 1, as well
as are the ear protective devices 118, 118.

The actual chamber in this case is formed by the
member 150, which is contoured so as to fit over the
nose and mouth of the user and has a sealing gasket 151
secured thereto so that when properly adjusted, it will
form an air-tight chamber similar to that described
above. The member 150 is pinned to the face shield
111 at 152, 152.

This form of the invention also includes the inlet
and outlet tubes 130 and 131 with valves 130c, 131c as
well as the communication devices 140 and 141. With
regard to the air inlet and exhaust means and the com-
unication means, these in reality would be identical to
those shown in FIG. 1, and operation of the mask
would be similar, with the principal difference being
that the entire face of the user is not enclosed as is the
case in the form of the invention shown in FIG. 1,
thereby achieving some advantage in comfort particu-
larly in warm weather.

Turning next then to FIG. 3 for a still further mod-
ified form of the invention, in this case, the member
forming the chamber is generally indicated by the nu-
meral 200 and consists of a rigid plastic cup member
201 contoured to fit over the nose and mouth of the
user. This cup member 201 carries a gasket 202 to en-
sure an air-tight seal when the device has been properly
adjusted.

This form of the invention also includes the air inlet
and outlet tubes 230 and 231 with valves 230c, 231c
which function identically with the tubes shown in
FIGS. 1 and 2.

This form of the invention, however, omits the shield-
ing of the face, per se, and is concerned only with pro-
viding an air-tight seal about the nose/mouth area alone
as would be the case in utilizing the invention in a med-
ical operating room.

A different form of headband mounting means is also
disclosed in this form of the invention and consists of
a pair of straps 216 and 219 which are pinned or other-
wise secured to the shell 201 by rivets or similar attach-
ing means 217, 218, 220, and 221.

This form of headband is adjustable in that the legs
222 and 223 of the strap 219 have a series of perform-
ations 222a and 223a in their outboard ends. These per-
forations engage the members 216a and 216b and per-
mit adjustment of the mask to fit the individual user’s
head. In this form of the invention, communication
means 240 would also be required.

A still further modification is shown in FIG. 4 in
which a total head mask is employed. This head mask
301 completely encloses the head of the user and is se-
cured to a suit similar to a deep-sea diver’s suit or astro-
naut’s suit, except that expired air is not exhausted to
the immediate atmosphere. This form of the invention
requires a completely sealed situation which may be ac-
complished by sealing off the helmet from the suit or
sealing the suit by pressure cuffs at the wrists and ankles in known fashion.

The helmet 301 includes a face plate 312 which is clearly to permit the user to have unobstructed vision.

The usual air inlet and exhaust tubes 330 and 331 with valves 330c and 331c are again employed and function similarly to the tubes in FIGS. 1 and 2. Communication means 340 are also provided.

Again, it should be noted that these tubes are illustrated as being in front of the wearer, but in practice, would be behind as described above with regard to FIG. 1. They are illustrated this way for clarity of illustration.

It has been shown, therefore, how a new and improved means of bacteriologic control has been achieved by providing a complete air-tight seal around at least the nose and mouth area of the wearer. It is also noted that with this type of arrangement, the contaminated air can be exhausted completely out of the operating room, for example. As noted above, it can be either recycled or it can be simply exhausted to the atmosphere, such as for example outside of the building.

It should also be noted that no particular materials have been specified in most instances. It is believed that the tubing would, of course, be some conventional pliable tubing made of some elastomeric material, while the face shield or face plate, as the case may be, would preferably be made of some light-weight material, such as plastic, which is rigid enough to hold its contour with capabilities of optical accuracy, but which would not cause undue strain on the wearer due to the weight thereof.

It should also be noted that while the invention has been illustrated and described in connection with dental operations, it is believed apparent that the principles involved would be equally applicable to medical applications. Furthermore, and while the invention does obtain the complete bacterial control desired, the unique closed compartment concept also would permit the principles of the invention to be utilized in other areas where bacterial control is not of paramount importance but where complete atmospheric control is desired. Thus, almost any situation in which recycling of the oxygen is desirable such as in deep-sea diving, machine shop operations, etc., would present a suitable area of use for the principles involved herein.

While a full and complete description of the invention has been set forth in accordance with the dictates of the Patent Statutes, it is understood that modifications can be resorted to without departing from the spirit hereof or the scope of the appended claims.

What is claimed is:

1. Means for totally controlling the bacterial-virus communication between an operator's respiratory system and the environment of the surrounding operating site comprising:
   A. a mask
   1. adapted to enclose at least the nose, mouth and chin areas of the wearer's face;
   B. sealing means
   1. carried by said mask for
   2. sealing said mask to the wearer's face to form an air-tight chamber;
   C. adjustable mounting means for securing said mask to the wearer's head;
   D. air inlet means attached to said mask and adapted to be connected to a remotely positioned source of purified air and provide said air to said chamber;
   E. a totally leakproof exhaust means attached to said mask for removing expired air from said chamber and from the immediate surrounding operating environment; and
   F. said air inlet means and said exhaust means being positioned on said mask in horizontally and vertically spaced relationship to each other and with the nose-mouth area of the wearer being disposed between said air inlet and exhaust means;
   G. with said exhaust means being disposed above the plane of said air inlet means whereby a curtain of air is directed across the respiratory openings of the wearer.

2. The device of claim 1 further characterized by the presence of pressure control means operatively associated with said air inlet means and with said exhaust means.

3. The device of claim 1 further characterized by the presence of
   A. a face plate carried by said mounting means and having an eye shield therein;
   B. said mask being carried by said face plate.

4. The device of claim 3 further characterized by the presence of magnifying means carried by said face plate.

5. The device of claim 4 wherein said magnifying means are movable into and out of covering relationship with said eye shield.

6. The device of claim 3 further characterized by the presence of hearing obturators carried by said mounting means.

7. The device of claim 1 further characterized by the presence of communication means carried by said mask.

* * * * *