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W. C. BECK  
SURGICAL MASK

2,983,271

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2 Sheets-Sheet 1

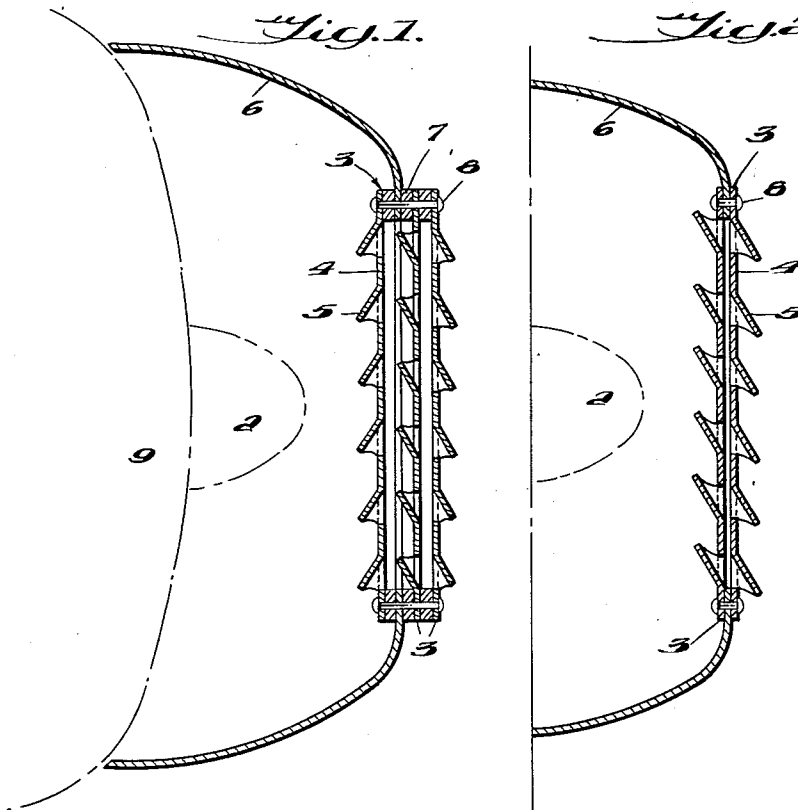
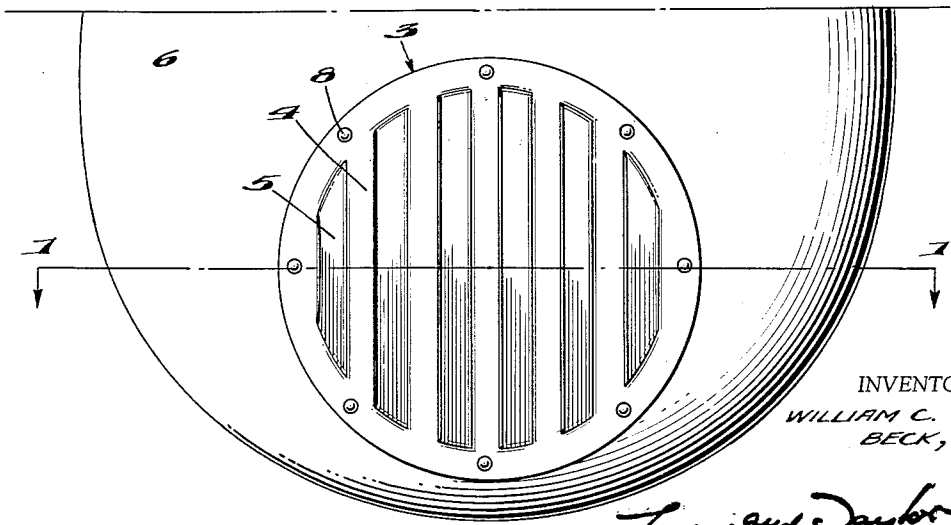


Fig. 3.



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2 Sheets-Sheet 2

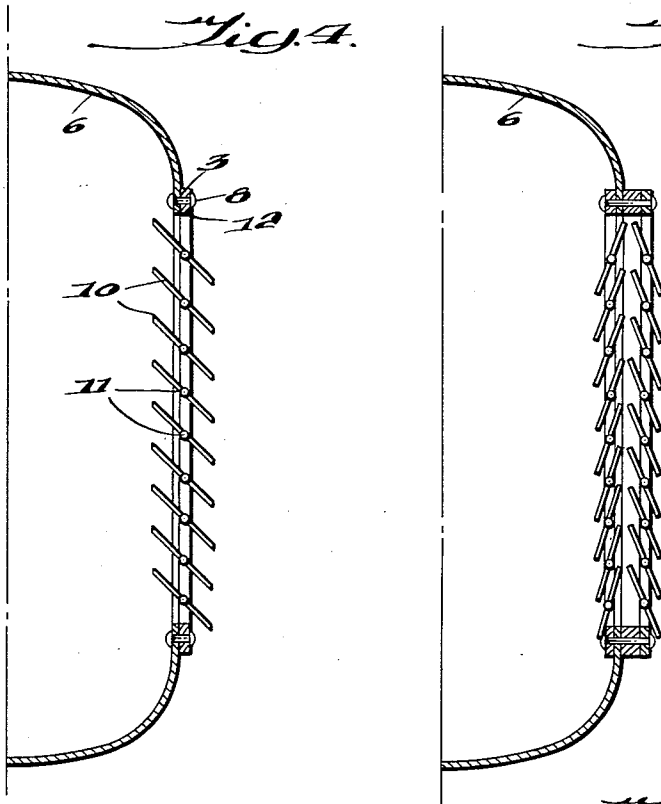
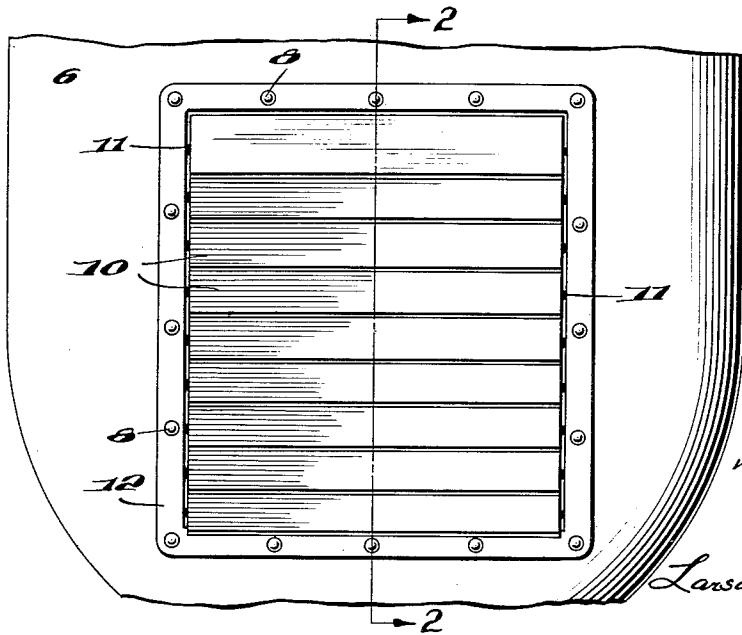


Fig. 6.



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**SURGICAL MASK**

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4 Claims. (Cl. 128—146)

The invention described herein is concerned with a new form of surgical mask. More in particular, the invention relates to a surgical mask having means for substantially preventing outward passage of bacteria-laden droplets entrained with expired air, the means allowing free and unimpaired breathing all the while.

This means is comprised of one or more slatted panels arranged across one or more apertures in the mask proper and within the breathing zone of the wearer. In essence the slats are arranged within each panel to form louvered openings, that is, openings between slats which are disposed angularly within the plane of the panel such that bacteria-laden droplets entrained with the air expired by the wearer impinge upon the slats to be immobilized there as the air flows on through the openings. Thus, in one embodiment of the invention, the slats are arranged much like the shutters of a Venetian blind. In another embodiment, the slats have two legs, one of which lies within the vertical plane of the panel, the other of which extends away from the plane at an acute angle with it. In this instance, the openings lie between the juncture of the legs and the adjacent vertical leg of the next slat. In either instance, air moving against the panel to escape between the slats must undergo a turn upon striking the slats, whereupon the air-borne bacteria-laden droplets impinge upon the slats and remain behind.

It has been amply proven heretofore that if droplets emanating from the mouth and nose strike any solid object, they will not rebound into the air but will adhere to the object and remain immobilized there. It is largely upon this premise that the instant invention is based. The art has employed this principle in the past but only with resultant difficulties in breathing through the device. For example, surgical masks have been made of several layers of a fine mesh cloth. Such masks have acted only as partial barriers to the passage of droplets expectorated from the mouth and nose during breathing, talking, sneezing, or coughing. For small droplets have been able to penetrate the interstices of the cloth. Solid barriers in the form of plastic and glass have been interposed between the cloth layers, but the use of such masks has made breathing quite difficult. While these masks have worked to completely stop the passage of bacteria-laden droplets, a more satisfactory surgical mask from the standpoint of unobstructed breathing together with effective interception of the droplets has been sought. Accordingly, it is an object of the instant invention to provide a surgical mask which enables the wearer to breath freely while providing a substantial barrier to the passage of bacteria-laden droplets into the air surrounding the wearer. Other objects will become apparent from the description herein and the claims appended hereto.

It has been found in accordance with the present invention that when a system of shutters, one much like a miniature Venetian blind, or some other type of slatted panel is placed within the breathing zone of a person, such as before the mouth and nose, an effective barrier against the passage of bacteria-laden droplets expecto-

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rated from the mouth and nose is formed although breathing remains free and unimpaired. This is possible because of the angular disposition of the shutters or slats within the plane of the panel. Expectorated particles and droplets flying toward the shutter system or panel impinge upon the shutters or slats as the expired air undergoes a turn in order to pass through the channels between shutters or slats.

It is apparent therefore that the invention contemplates the employment of slats arranged to form louvered openings. In one embodiment, the invention employs slats arranged as flat shutters angularly disposed within the plane of the panel, the channels between the shutters comprising the openings. In another embodiment, the invention employs slats comprised of two legs, the first of the legs lying in the vertical plane of the panel, the second of the legs extending at an acute angle with the plane. The openings thus lie between the juncture or bight of the vertical and angularly disposed legs and the adjacent vertical leg of the next slat. It has been found in the case of the latter embodiment that when the angularly extending leg of each slat extends away from the plane of the panel at such an angle and is of such a length as to intersect the horizontal projection of the edge of the adjacent vertical leg of the next slat, substantially complete interception of droplets and particles expectorated against the panels is achieved.

Tests have also shown that by increasing the number of slatted panels arranged in juxta-position within the breathing zone of the wearer it is possible to increase the efficacy of the surgical mask to prevent the flow of bacteria-laden droplets into the atmosphere around the wearer. For example, by spraying pathogenic bacteria against a culture medium, increasing degrees of bacteriological effectiveness have been acquired by interposing one, two, and three panels between the spray and the culture medium. Therefore, the instant invention further contemplates the use of two or more slatted panels arranged in juxta-position across the breathing aperture of a surgical mask. Ordinarily, the panels are placed in inverted relationship to one another in order to achieve the greatest efficacy.

The mask proper may be so shaped as to either form a close face-tight fit for the wearer, or to form a loose fit such that the mask constitutes only a shield drawn before the mouth and nose of the wearer and tied behind his head. It is conceivable that the entire shield comprise one or more slatted panels, such as to draw a miniature Venetian blind before the wearer's nose and mouth. But in preferred embodiments, the mask has an aperture of two to five inches in diameter at some point within the breathing zone of the wearer, over which is mounted a breathing piece comprising one or more slatted panels arranged in juxta-position as disclosed herein. Both the breathing piece and the mask proper can be made of any suitable material used by the art for these purposes. For example, the breathing piece can be made of rubber, plastic or metal.

The attached drawings illustrate several embodiments encompassed within the invention. Others are readily conceivable to those skilled in the art on the basis of the disclosure herein.

Figure 1 is a cross-sectional view taken through line 1—1 of Figure 3. In this instance the breathing piece comprises three slatted panels.

Figure 2 is a cross-sectional view taken through the same line, but in this instance showing a breathing piece having only two slatted panels.

Figure 3 is a front elevation view of the lower section of a mask and illustrating in particular a breathing piece having panels comprised of two-legged slats.

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Figures 4 and 5 show cross-sections through line 2—2 of Figure 6 of breathing pieces with one and two shutter systems arranged in juxta-position, respectively.

Figure 6 is a front elevation view of the lower section of a mask wherein the panels of the breathing piece are comprised of one or more shutter systems.

According to the invention, the mask 6 is attached about the wearer's head so as to remain mounted before his face 9 and ordinarily with the breathing piece positioned in the breathing zone of the wearer before his mouth and his nose 2. The breathing piece may be of any appropriate geometrical shape, such as round, square, or rectangular in outline. In the figures herewith, the breathing piece is shown to comprise one or more round or rectangular slatted panels 3. In Figures 1—3, the slats are shown as having two legs. Each slat has a vertical leg 4 and an angularly disposed leg 5 joined to the vertical leg. The slats may be formed integrally or formed as two legs joined together by some method such as welding. If the panel is formed by punching out the legs 5, the legs 5 will not have sufficient length to intersect the horizontal projection of the edge of the adjacent vertical leg of the next slat. Such a panel when used singularly as the breathing piece, will have limited advantage as a barrier to the passage of bacteria-laden droplets and particles. If, on the other hand, the legs 5 are made of sufficient length and left at such an angle as to intersect the horizontal projection of the adjacent vertical leg, increased effectiveness is acquired. However, in practice it has been found to be more advantageous to employ two or more panels. Figure 2 shows a cross-section of a mask having two panels, the two panels juxta-posed in inverted relationship. The panels 3 are linked with the solid portion of the mask at the periphery of the breathing aperture with rivets 8 or some other similar means. In Figure 1 an embodiment wherein three panels are employed can be seen. In this instance, spacers 7 are used to further separate at least two of the panels. The panels need not be separated but preferentially they are separated by an amount comparable to the thickness of the mask at least. In either of the two embodiments, the angularly disposed legs 5 can be extended to intersect the horizontal projection.

In Figures 4, 5, and 6, the panels 3 are seen to comprise a system of shutters 10. The shutters 10 are affixed to rods 11 which run between opposite sides of the rim 12 to carry the shutters 10. In like manner to the other embodiments, the panels 3 are attached to the solid portion of the mask with rivets 8 or some other similar means. It will be seen that in this case the system of shutters resembles a miniature Venetian blind. Accordingly, the shutters sufficiently overlap to afford an excellent barrier to the passage of bacteria-laden droplets and particles sprayed against the breathing piece without obstructing normal breathing. Greater bacteriological advantage can be gained from the employment of two of these shutter systems on two panels as shown in Figure 5.

While the description herein has been limited to modes of the invention wherein no more than three panels are combined to provide the breathing piece, it is further contemplated that a multi-layer complex of panels can be used to provide a breathing piece more of the nature

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of a filter. In such an instance, the panels can be formed from an extremely thin but substantially rigid or semi-flexible sheet material such as plastic resin. Arranged in close order and having louvered openings, the panels of the complex can furnish one or more breathing pieces for filtering out particulate matter entrained with inspired air as well as expired air. Such a device can be employed for short durations for operations within atmospheres heavily-laden with coal or rock dust, for example.

As can be seen in Figures 3 and 6, the slats are shaped so as to leave the panels in smooth contour with the mask proper.

Although the invention has been described in considerable detail with reference to certain preferred embodiments thereof, it will be understood that variations and modifications can be effected without departing from the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

#### I claim:

1. A surgical mask comprising means attachable to the head for forming a shield and having a portion adapted to be disposed in alignment with the nose and mouth, a plane opening in said portion, and an assembly across said opening including a series of parallel slats, the slats having their axes in a plane parallel to the plane of the opening and having at least a portion of each slat at an angle to said plane of the opening, said slats being spaced apart to form louver-like openings, and being of such lateral extent and so angularly disposed with respect to the plane of the opening that the projection of any slat normal to the plane of the opening intersects at least one adjacent slat.

2. A surgical mask according to claim 1 wherein said assembly constitutes a panel and a plurality of like panels are juxtaposed in parallel at said opening, each panel being inverted with respect to adjacent panels and the slats thereof having their angular portion so angularly disposed that any plane passed normal to and through the opening intersects at least two of the slats among the plurality of panels.

3. A surgical mask according to claim 2 wherein the slats have first and second integral portions, the first portions of the slats being disposed in parallel with respect to each other and parallel to the plane of the opening, and the second portions of the slats being disposed in parallel with respect to each other and at an angle to the plane of the opening.

4. A surgical mask according to claim 3 wherein each of the second portions extends away from the first portion with which it is integral to an extent overlapping the horizontal projection of the first portion of the adjacent slat.

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