

June 12, 1951

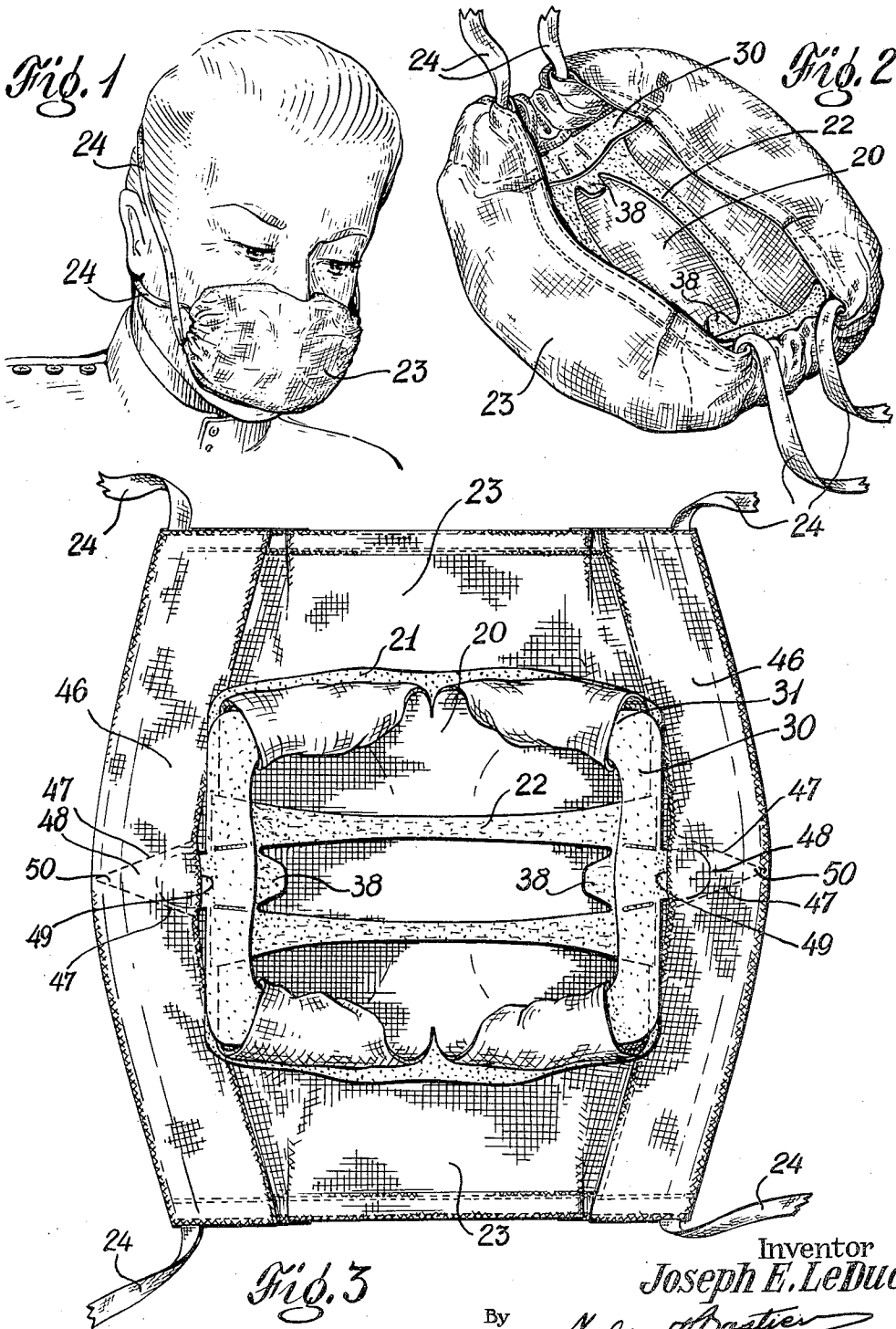
J. E. LE DUC

2,556,589

SURGICAL MASK

Filed March 5, 1949

4 Sheets-Sheet 1



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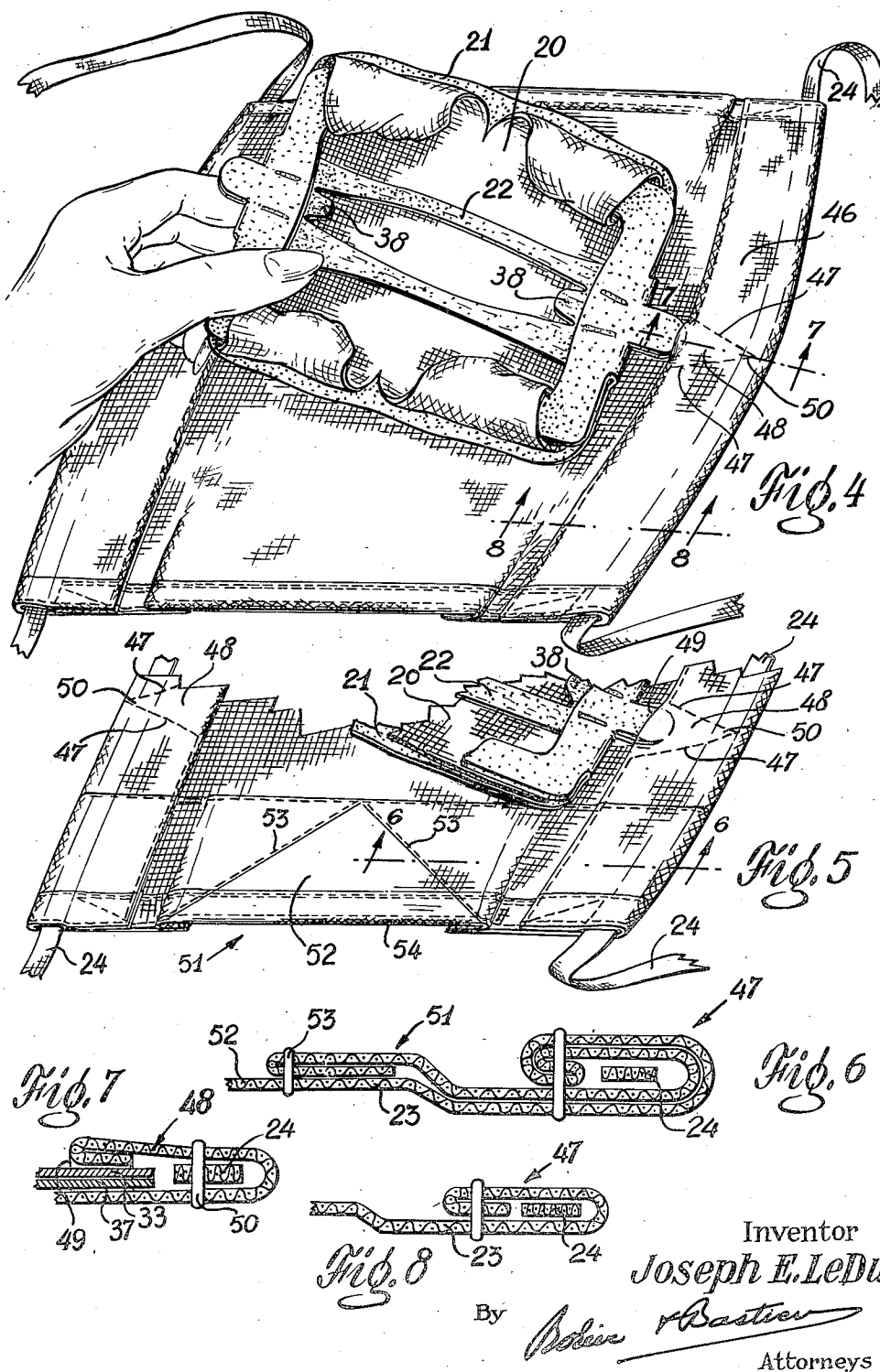
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4 Sheets-Sheet 2



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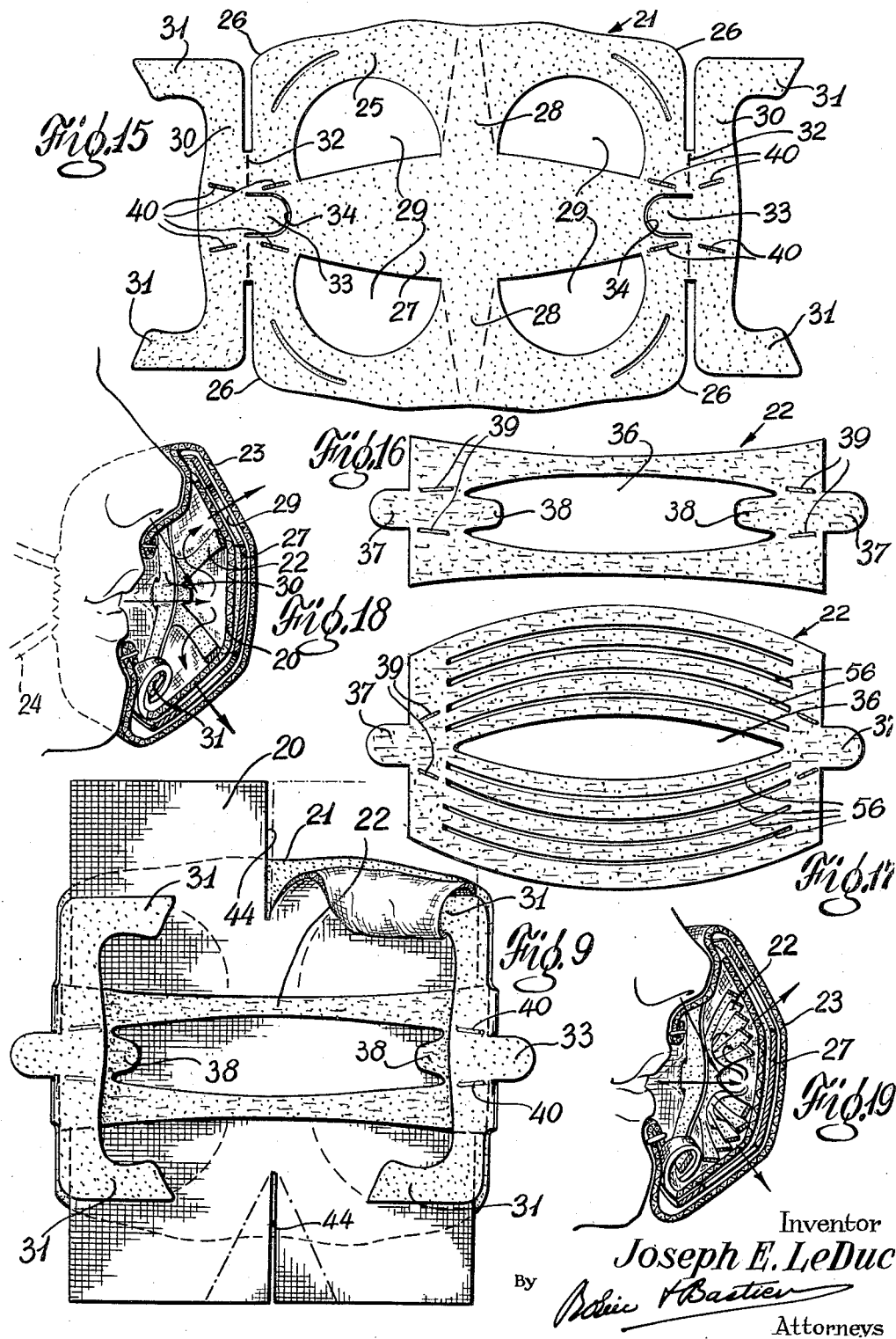
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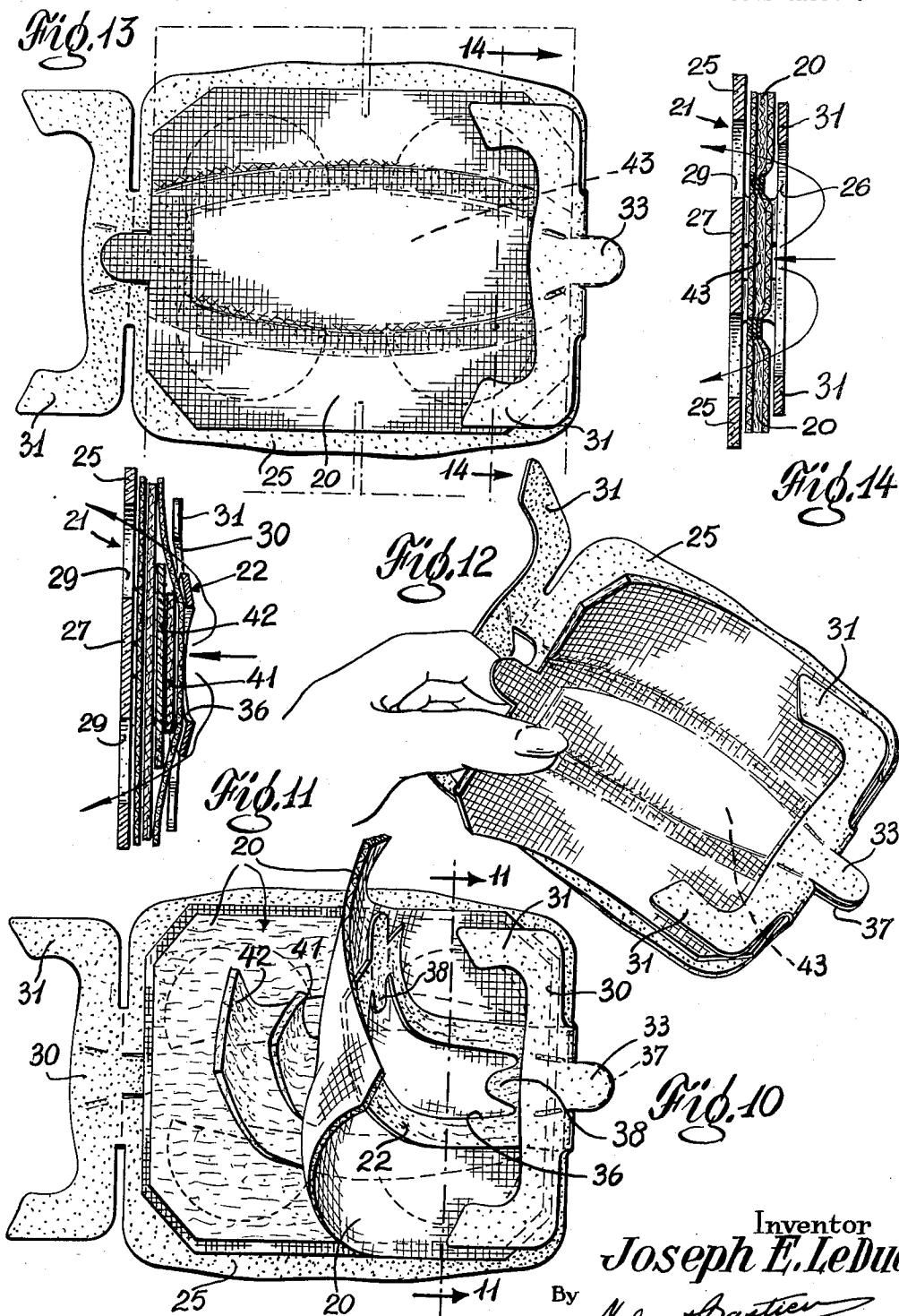
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SURGICAL MASK

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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SURGICAL MASK

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6 Claims. (Cl. 128-146)

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The present invention relates to a mask for doctors and other medical personnel, especially for those present during surgical operations.

More specifically, this invention concerns a mask such as is worn over the face of those concerned, covering particularly the nose and mouth, for the purpose of preventing exhalation of vapors and germs whilst at the same time permitting easy breathing.

The underlying principle of these devices is that they obstruct the free and direct flow of air between the atmosphere and the breathing orifices of the person masked, the exhaled air being urged to pass through layers of material capable of filtering vapors and suspended germs therefrom before being allowed to re-enter the atmosphere of the operating theatre. In this manner the germs exhaled by a masked person may not be transmitted to anyone present, especially the patient.

The main object of the invention is to provide a mask of the character described which is of improved nature.

Another important object resides in the provision of a mask of the nature set forth which, though effective in use, is comprised of replaceable parts which are easily assembled or separated.

Yet another object resides in the provision of a mask such as is set forth above which, though simple in design, is capable of better sealing the nostrils of the wearer against contact with the atmosphere.

Still another object is to provide such a mask wherein the several parts are of simple and economical design, and may, with the exception of the filter material, be sterilized and used again and again.

And another object is to provide a mask of the character set forth which is easily fitted upon the face of any human being.

As an additional important object of the invention the mask, when in extended operative position, is adapted to prevent moisture of the exhaled breathing air from spreading towards the outer vents, which must be kept dry, if efficient operation of the mask is to be maintained.

A further object is the provision of a respirator of the character described which can be worn without fogging the glasses of a wearer.

Other objects and advantages will become apparent, or be further pointed out, in the description to follow.

As an example, and for purposes of illustration only, a preferred embodiment of my invention is shown in the annexed drawings, wherein:

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Figure 1 shows a perspective view of a mask fitted upon the face of a wearer;

Figure 2 shows a perspective view looking towards the inside of the mask when assembled ready for wear;

Figure 3 shows a plan view of the inside of the mask;

Figure 4 shows a perspective view similar to Fig. 3 illustrating the separation of the inner parts from the outer covering;

Figure 5 is a fragmentary view similar to Fig. 4 indicating proposed alternative designs;

Figure 6 is a section taken along line 6-6 of Fig. 5;

Figure 7 is a section taken along line 7-7 of Fig. 4;

Figure 8 is a section taken along line 8-8 of Fig. 4;

Figure 9 shows a plan view of the mask interior parts indicating the manner in which the filter material is arranged with respect to the framework and baffle member;

Figure 10 shows a view similar to and more detailed than Fig. 9, of a proposed alternative arrangement;

Figure 11 shows a section taken along line 11-11 of Fig. 10;

Figure 12 shows a perspective view of the main frame and baffle members of the mask and indicates how the filter material is held thereby;

Figure 13 is a plan view of the structure shown in Figs. 11 and 12, partly broken away;

Figure 14 is a section taken along line 14-14 of Fig. 13;

Figure 15 shows a plan view of the baffle and main frame of the mask;

Figure 16 shows a plan view of another frame member of the mask co-operable with that of Fig. 15 to hold the filter material in place;

Figure 17 is a plan view of an alternative form of construction for the member of Fig. 16;

Figure 18 is a section through the mask when in use indicating operation thereof when using the most preferred embodiment of parts, and

Figure 19 shows a similar section but utilizing the alternative embodiment for one of the frame members shown in Fig. 17.

Referring now to the drawings, wherein the same reference characters indicate corresponding parts throughout, the mask is seen to consist generally of layers of material 20 adapted to filter moisture from gases projected against or passing therethrough, a main frame member or card 21 upon which the filter material rests and which includes transverse baffles for obstructing the flow of air through the mask, a secondary frame card

22 releasably affixable across card 21 in the vicinity of the wearer's mouth to hold the filter material in place, and an outer covering 23 of air-passing gauze or the like in which the other parts of the mask are detachably secured, the mask being fitted on the wearer's face as by means of tapes or strings 24 attached to covering 23.

Figure 15 best shows the preferred pattern adopted for the main frame card 21. The card has a peripheral frame portion 25 extending around the approximately rectangular outline (with rounded corners 26) across which is provided a central, transverse baffle portion 27 adapted to lie over the mouth and nostrils of the wearer to prevent air being exhaled directly to the atmosphere. From the top and bottom of frame 25 members 28 extend medially in to join the central portion of the baffle both to reinforce the latter and to aid in preventing unobstructed outward passage of air from mouth and nostrils. Hence only four apertures 29 are provided, approximately in each corner of the card, to allow passage of gases therethrough.

The card also possesses on each end a foldable wing member 30, this wing member being yoked and having an outwardly projecting member 31 at the top and bottom thereof for reasons which will become apparent. The wings 30 and frame 25 are connected only along the seams 32, whereby the former may be folded inward so that members 31 project in across the top and bottom of the frame as seen in Figs. 9 to 13, inclusive. Moreover, for reasons described below, a rounded tab 33 is provided projecting into the frame 25 (past seam 32) from the mid-portion of each wing, these tabs normally lying in larger, similarly-shaped apertures 34 cut through frame 25 (only the edges of which are visible) and adapted to project out from the frame 21 when the wings are folded in.

The secondary frame members 22 may be shaped similarly to either of the alternative types shown in Fig. 16 or 17, the latter of which will be described briefly afterward. As seen card 22 of Fig. 16 is generally rectangular in shape and has an oval, transverse aperture 36 therethrough adapted to lie over the wearer's mouth and permit passage of air therethrough. From each end of the card extends a tab 37, similar to tabs 33, and these will extend through apertures 34 and lie behind tabs 33 (when wings 30 are folded in) so as to hold the two cards detachably together (Fig. 9). If desired, the two cards may be further maintained in registering position by the co-operation of projecting ribs 39 on card 22 with slots 40 formed through the wings and frame of card 21. As a further help in positioning the member 22 of Fig. 16, inner tongues 38 are formed at the ends of aperture 36, as will be evident later on.

The filter material 20 is held between and by the co-operation of cards 21 and 22, and may be in the form of several layers or sheets, each of absorbent material (such as cotton batting) adapted to filter all moisture or vapors from the gases passing therethrough. Naturally the germs suspended in the minute globules of moisture exhaled will also be removed. Figures 10 to 13 inclusive show alternative arrangements of such material, ranging from the multiple, different-sized layers of Figs. 10, 11 and 12 to the composite pressed pad of Figs. 13 and 14. In each case the material will be preferably thicker at that portion of the mask (represented by baffle 27) where the breath is exhaled directly from

the mouth and nostrils, as at 41 and 42 in Figs. 10 and 11 and at 43 in Figs. 13 and 14. In either case the more expansive sheets of material outside the thicker portion may have dimensions approximating those of frame 25, or, as in the case of Figure 9, will extend above and below the frame and will be slit as at 44 so as to be capable of being folded, at each corner, over the corresponding inwardly-projecting member 31. This last arrangement will not only hold the filter material more securely with respect to frame card 21, but will also provide increased thickness of the mask on each side of the nose when worn, hence rendering escape of unfiltered air at this point less likely. Such escape of air is particularly annoying and will often cloud a physician's glasses whilst working. It is prevented in another manner described below when the method illustrated in Fig. 9 is not employed.

The frame cards and filter material, when assembled as a unit according to any of the foregoing arrangements, are then releasably affixed in outer covering 23. The latter, as seen in Figs. 3, 4 and 5, comprises a single or multi-layer sheet of gauze (or the like) reinforced about its edges and folded in at the right and left sides to form enlarged hems 46. Centrally of each hem 46 the divided seams 47 define a triangular pocket 48, the inward edge 49 of which is open so as to receive the projecting tabs 33, 37 of the frame cards. In this manner the interior unit of the mask may be releasably fitted in covering 23. Draw strings 24 may then be connected to the covering inside the hems, as at 50, and secured around the wearer's head to hold the mask in place. That is, a tape may be secured at one end to the upper boundary of a pocket 48, passed outside the hem, around the wearer's head, into the other hem and attached to the other pocket 48. The same may be done with a lower tape. When the tapes are loose, the mask may lie flat as in Fig. 3, being drawn up as in Fig. 2 when tension is applied to the tapes. When the mask is fitted on the wearer's head, it adopts the position of Fig. 1, the tapes 24 being crossed.

In lieu of the arrangement of Figure 9 for preventing escape of air around the nose, it is proposed that the top and bottom edges of the outer covering be folded to apply the necessary pressure, whereupon the filter material need be made only with an outline approximating that of frame 25. In this case (Fig. 5) the mid-portions of the top and bottom of the covering have a hem 51 which is of a plurality of thicknesses except for the thinner, central triangular portion 52 defined by outwardly inclined seams 53 and edge 54 of the covering.

As the mask is drawn over the face, this hem 51 becomes doubled over and the edges 53 of triangle 52 press (at the top) inward on the nose to prevent escape of air therearound. Figs. 18 and 19 indicate sections through a mask with the top arranged in the manner just described and with the bottom arranged as in Fig. 9, although in practice it will be preferred that either one or the other arrangement be adopted for a single type of mask.

Figure 19 also shows in operation a mask having a secondary frame card 22 of the type of Fig. 17. In this case, that portion of the card surrounding aperture 36 is enlarged and approximately oval in outline, having the top and bottom divided by parallel, curved slits 56 into a lattice work arrangement. As a mask with such a card is drawn over the features, the slats of the lat-

ticework separate in the manner of Fig. 19 and the air stopped by baffle 27 from exiting must flow around one of the slats before escaping through the filter material.

It will be clear, from the foregoing, that the present invention fulfills the objectives set forth above and provides a variety of alternative mask arrangements of improved effectiveness. Masks so constructed are easily assembled or taken apart, and all of the pieces except for the filter pads or material may be sterilized and reused many times. The parts are of simple and economical design, and may be standardized in size and shape to fit any human face. The mask is easily and quickly fitted upon the face, and acts to filter out germs and prevent steaming or clouding of the wearer's spectacles. Moreover, the whole arrangement is symmetrical about a medial longitudinal line and may be reversed top for bottom, thus precluding the possibility of the mask being put on in a wrong manner by the wearer.

From the foregoing description it should be clear that the mask of the present invention is an advance of the art: more specifically, the following features and characteristics can be reiterated.

The projecting tabs of the center part are automatically erected and strengthen the frame, said automatic erection occurring when the mask is being formed. Also, the slats act as so many springs which, as the mask is formed from its flat position, urge the gauze into closer adherence with nose and chin of the wearer, the result being a mask wherein moist air escape around the nose is avoided, keeping spectacles fog-free, said air being directed towards the side vents which are kept dry.

In accordance with the invention, the various gauze layers are so designed as to control adequately the air circulation and trapping of bacteria; said design directs air currents towards the vent and consists in the doubling up of gauze at strategic points. This may be achieved also by enlarging the cotton area on the refill, the outer gauze being single. This particular design may be extended to eliminate the inner cardboard form by means of rigid, or score, lines made in the cotton refill, thereby simplifying manufacture: in certain specific cases, three gauze layers may serve as deflectors.

It will be understood that I do not limit my invention to any or all of the particular embodiments thereof herein shown and described, since obviously various alterations might be made in the size, shape and arrangement of parts, always within the scope of the subjoined claims, without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In a surgical mask of the character described adapted to fit over the mouth and nose of the wearer, a frame including baffles adapted to obstruct air exhaled by the wearer, material for filtering air so obstructed, means for detachably fixing said material in said frame, an air-passing outer mask covering, said means, material and frame so constructed and arranged to fit releasably in said covering, and means connected to the mask for holding same in operative position, said frame including projecting lateral portions foldable to overlay and hold said filter material against the frame.

2. In a mask as claimed in claim 1, said projecting lateral portions including members extending inward across the top and bottom at

each side of the frame when folded thereover, and said filter material constructed and arranged at each corner for folding over the corresponding inwardly-extending member whereby the material is more firmly held relative to the frame and whereby folds of such material are provided to pinch inwardly on the nose and prevent escape of unfiltered air therearound when the mask is drawn over the wearer's face.

3. In a surgical mask of the character described adapted to fit over the mouth and nose of the wearer, a frame including baffles adapted to obstruct air exhaled by the wearer, material for filtering air so obstructed, means for detachably fixing said material in said frame, an air-passing outer mask covering, said means, material and frame so constructed and arranged to fit releasably in said covering, and means connected to the mask for holding same in operative position, said means for fixing the material including a secondary frame member detachably co-operable with the main frame to hold the material therebetween.

4. In a mask as claimed in claim 3, said main frame provided with lateral portions foldable over the secondary frame member to hold same in place, tabs projecting laterally from said co-operative frame members, and pockets in said outer covering adapted to detachably receive said tabs to hold the frames and the filter material in position.

5. In a surgical mask of the character described adapted to fit over the mouth and nose of the wearer, a frame including baffles adapted to obstruct air exhaled by the wearer, material for filtering air so obstructed, means for detachably fixing said material in said frame, an air-passing outer mask covering, said means, material and frame so constructed and arranged to fit releasably in said covering, and means connected to the mask for holding same in operative position, said outer covering having a folded over hem on at least the top mid-portion thereof, said hem having a multi-layer thickness except for a thinner triangular portion the edges of which are adapted, when the mask is drawn on the wearer's face, to lie snugly against the sides of the nose and prevent escape of unfiltered air therearound.

6. In a surgical mask of the character described adapted to fit over the mouth and nose of the wearer, a frame including baffles adapted to obstruct air exhaled by the wearer, material for filtering air so obstructed, means for detachably fixing said material in said frame, an air-passing outer mask covering, said means, material and frame so constructed and arranged to fit releasably in said covering, and means connected to the mask for holding same in operative position, said means comprising a secondary frame member co-operable with the first to hold said material therebetween, said secondary member having a central aperture adapted to lie between the wearer's mouth and said baffles when in operative position, and latticework above and below said aperture around which air obstructed by said baffles will pass.

JOSEPH EDOUARD LE DUC.

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