July 21, 1959 J. N. MATHESON 2,895,472

RESPIRATOR

Filed Jan. 5, 1956 2 Sheets-Sheet 1

Fig.1.

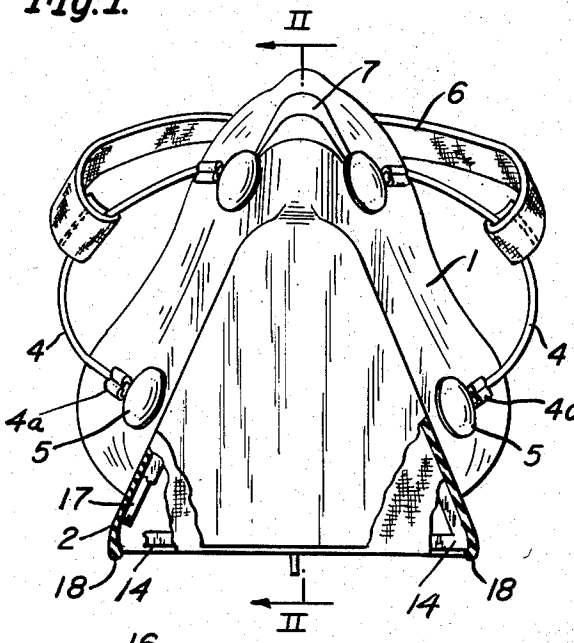
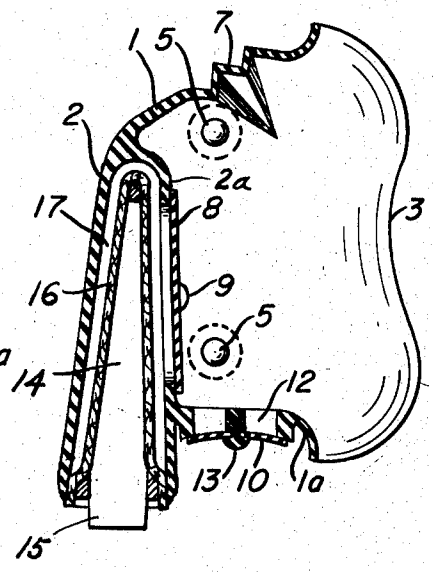


Fig.2.



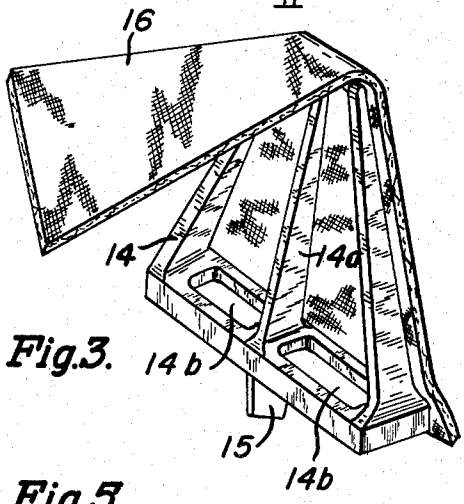


Fig.3.

Fig.4.

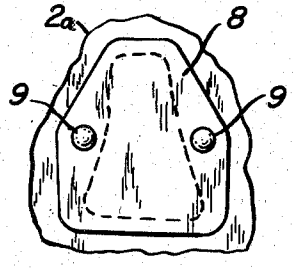
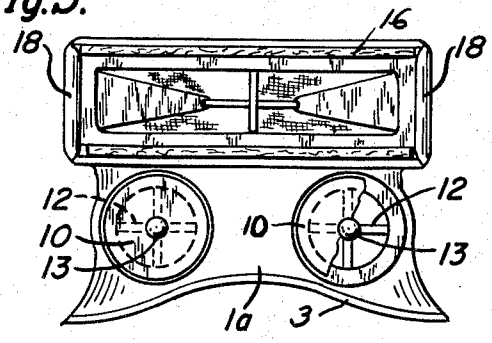


Fig.5.



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RESPIRATOR

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FIG. 7

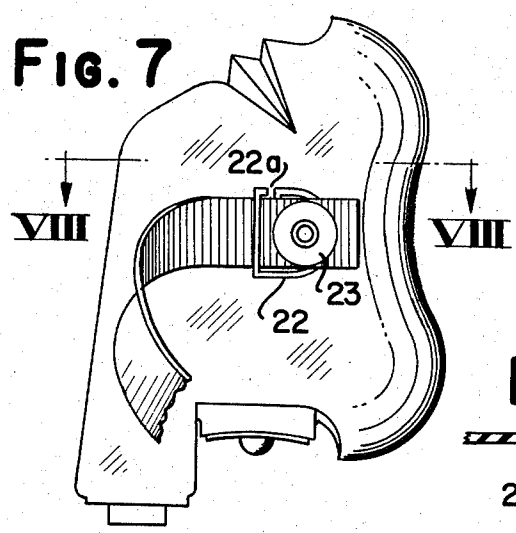


FIG. 6

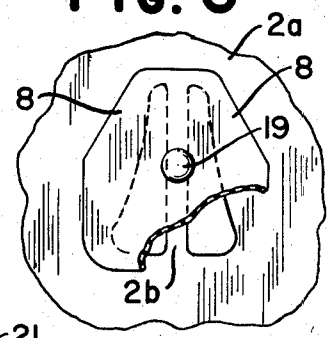


FIG. 8

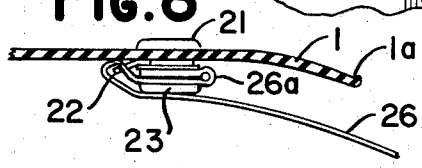


FIG. 9

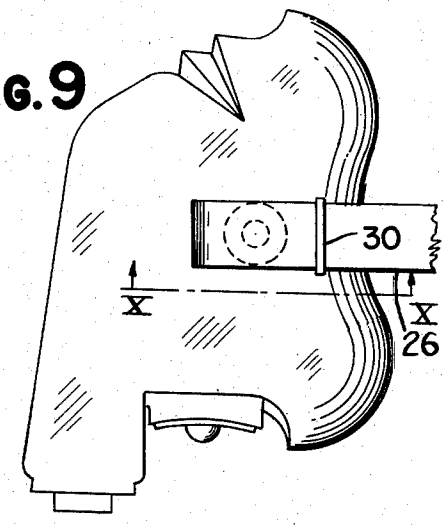


FIG. 11

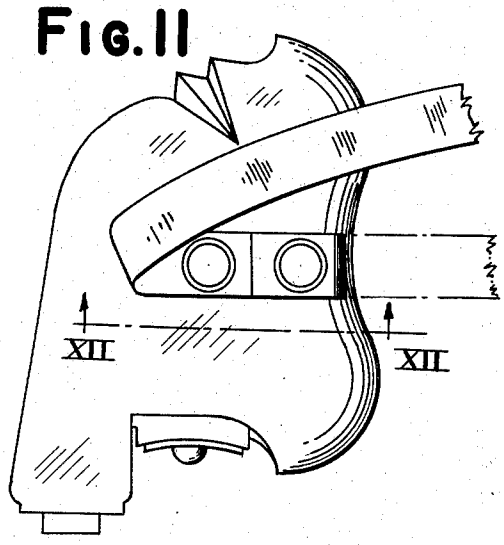


FIG. 10

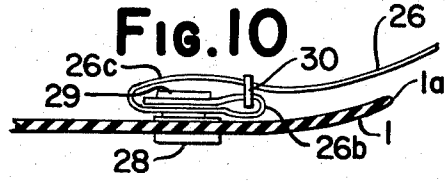
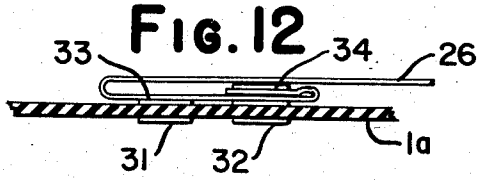


FIG. 12



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United States Patent Office 2,895,472 Patented July 21, 1959

2,895,472

RESPIRATOR

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Application January 5, 1956, Serial No. 557,466

22 Claims. (Cl. 128—146)

This invention relates to a respirator, and, more particularly, to an industrial respirator including a face piece and removable filter for filtering dust and obnoxious fumes.

This application is a continuation-in-part of my copending application, Serial No. 481,950, filed January 14, 1955, now Patent No. 2,874,693 issued February 24, 1959.

Common types of industrial respirators including a removable filter have generally been made in two parts, namely a face piece and a filter box or holder, detachably secured to the face piece in an air tight manner. This type of respirator has an outstanding disadvantage in that it is extremely difficult to maintain a perfectly air tight fit between the filter holder or box and the face piece, particularly after these parts have been detached and put together again a number of times. Another disadvantage is that in cleaning the respirator, it is difficult to clean all the parts without taking them apart and putting them back together again which consumes considerable time.

A further disadvantage of commonly used dust filtering respirators with removable filters and of the above described type is that in cases wherein the face piece is made of metal or other rigid material, a rubber liner is required on the periphery to form an air tight fit with the face. However, such liner does not provide a comfortable fit with the face because of the metal backing of the rigid face piece—moreover difficulty has been experienced in keeping the rubber liner in place in an air tight manner. Additional difficulty is experienced when the respirator is to be washed, necessitating the removal of the rubber liner.

Another disadvantage of commonly used respirators including a filter box with a removable filter pad, generally supported by a rigid, open plastic frame, is that considerable difficulty has been experienced in making a construction that is relatively fool proof in maintaining a dust tight connection with the filter. Commonly used types of respirators have a rigid filter holding box, and very commonly when the user replaces a filter he does not arrange the filter pad properly, or perhaps does not insert the filter pad and frame holder into the box sufficiently to insure an air tight connection between the filter holder box and the margins of the pad so as to prevent leakage into the respirator of dust laden air. Nor are suitable means provided for simply and securely holding or locking the filter pad and frame in place or for aligning the parts.

An object of my invention is to provide a respirator of the industrial type which is devoid of the above named disadvantages and which is integrally molded in one piece, instead of two detachably connected pieces, therefore which completely eliminates leaks between the face piece and filter box.

Another object of my invention is to provide a novel respirator including an integral rubber face piece and filter holding box of such construction as to insure a dust-tight fit with a removable filter pad and filter supporting frame and which will insure that the filter pad

and frame will be securely held within the holder at all times without the danger of dislodgment or loosening or the development of leaks.

A still further object of my invention is to provide an efficient respirator of relatively simple, inexpensive, one piece construction so that the entire respirator may be cleaned as a single unit without the necessity of disassembling the parts, and which is of such construction as to provide an extremely comfortable and cushioned fit with the face of the wearer so that it may be worn for long periods of time without discomfort and which will provide a truly air-tight fit about the nose, cheeks and chin of the wearer which greatly surpasses the fit usually obtained by previous type respirators.

Another object is to provide novel detachable headband fasteners that will insure an airtight fit.

Another object is to provide a headband construction for an industrial respirator which provides self-alignment and uniform distribution of pressure about the face-contacting margin of the mask, irrespective whether the mask is worn high or low on the head of the wearer.

Other objects and advantages of the present invention will become apparent from a study of the following description taken with the accompanying drawing wherein:

Figure 1 is a front, elevational view of an integrally molded respirator face piece and filter holding box embodying the principles of the present invention and showing parts of the box broken away to more clearly illustrate the internal construction thereof and of the removable filter and supporting frame contained therein;

Figure 2 is a longitudinal cross-sectional view taken along line II—II of Figure 1;

Figure 3 is a perspective view of the removable filter supporting frame and filter shown in Figures 1 and 2 but showing one flap of the filter in raised position to more clearly illustrate the frame construction;

Figure 4 is a fragmentary, rear view, taken from the right hand side of Figure 2, which shows the construction of the inhalation valve;

Figure 5 is a bottom view of the assembly shown in Figures 1 and 2;

Figure 6 is a fragmentary plan view of a modified form of air inlet valve having a single point of attachment to the mask;

Figures 7, 9 and 11 are side views of three modified forms of strap fasteners to insure an air-tight fit about the cheeks of the wearer and Figures 8, 10 and 12 are cross-sectional views taken along lines VIII—VIII, X—X and XII—XII, respectively, thereof.

Referring more particularly to the drawing, numeral **1** denotes a face piece of rubber or other similar flexible material, such as plastic material, and of somewhat pear shape outline, having integrally molded therewith a filter receiving box or holder **2** of substantially triangular outline, projecting forwardly and downwardly of the face piece **1** to form a one piece composite unit. The lower end of the filter box **2** is open and the rear is in communication with the interior space in the face piece through an inhalation valve **8** to be described hereinafter.

The mouth portion of face piece **1** is of somewhat pear shape outline and terminates in a feathered edge portion **3** sufficiently reduced in thickness so as to provide a readily flexible margin which will provide a cushioned, yieldable, comfortable, air-tight or dust-tight fit about the nose, cheeks and chin of the wearer.

The face piece is held against the face of the wearer by a self-aligning headband which fits about the head of the wearer and which comprises a pair of flexible straps **4** of rubber or similar material, having metallic terminals **4a** attached thereto having holes through which the shank portion of rivets **5** extend to attach straps **4** to the face

piece. Looped about intermediate portions of straps 4 on each side of the respirator are the sewed end loops of a head strap 6 of fabric or other suitable material. Thus regardless of varying directions of pull by head strap 6 as the result of placement thereof either high or low on the head, the head strap 6 will automatically slide along the intermediate portions of straps 4 so as to provide equalization to evenly distribute the pull on both of the rivets 4 and in this manner, the pulling force is applied substantially centrally of the face piece so as to apply even pressure about the entire periphery 3 of the face piece. Without this self-aligning feature of the head band, the pull would be unevenly distributed and would be concentrated on one portion of the face piece, depending upon whether the head strap 6 is worn high or low, thus would not insure a dust-tight fit on the face of the wearer.

In order to enable the face piece to fit different wearers having noses of different sizes and contours, one or more accordion pleats 7 are provided substantially centrally and forwardly of the nose surrounding portion of the face piece 1 so that the edge portion 3 of such nose surrounding portion may yield forwardly and fold the pleats as the result of pull of the face piece towards the face of the wearer. The accordion pleats not only provide yieldability and a more accurate and air-tight fit about the nose of the wearer, but enables the face piece to be worn either high or low upon a particular wearer's face or by different wearers, also it provides extreme comfort in wear because of the soft, highly cushioned effect it provides about the bony part of the nose which is the most sensitive part to abnormal pressures.

Intermediate the face piece 1 and filter holder box 2 there is disposed an integrally molded partition 2*a* having a central, substantially trapezoidal opening, shown in dotted outline in Figure 4, the margin of which forms a seat for a thin rubber inhalation valve diaphragm 8 of somewhat corresponding outline. Valve diaphragm 8 is held against the seat by two rubber supports 9, shaped like rivets integrally molded to the seat and which have shanks extending through holes in diaphragm 8 and have heads for retaining the valve diaphragm in place. The valve diaphragm is mounted on supports 9 by stretching the hole containing portions thereof to temporarily enlarge the size of the holes sufficiently so as to fit over the heads of supports 9. Such construction provides very little resistance to breathing because of the great freedom of flexing permitted at the top and bottom portions.

At the bottom of face piece 1 there is provided a substantially flat, horizontal outer wall, 1*a* also integrally molded with face piece 1 and box 2 and made of the same rubber. In the bottom wall 1*a* there are molded two exhalation valve openings of circular outline which surround radiating spokes 12 of rubber extending from a central hub-like portion, also of integrally molded rubber, to form a wheel shaped valve seat for providing an air tight seal with two disc shaped valve diaphragms 10 supported centrally on the hub portion of the seat by means of downwardly projecting rubber rivets 13 that extend through central holes of the diaphragm, similar to supports 9. Thus, a pair of exhalation valves are provided, each having a disc 10 of thin rubber, forming diaphragms which are very easily flexed by exhalation of the wearer to permit air to be exhaled outwardly of the face piece, but which, upon inhalation through valve 8, will form a seal about the perimeters of diaphragms 10 to close the valves and prevent inhalation of dust laden air.

The rubber filter receiving box 2 is of somewhat triangular shape having closed sides and being open at the bottom end for receiving a filter supporting frame 14, preferably of plastic material, and a filter 16 of felt or the like supported thereby. The frame 14 has a central rib 14*a* and a pair of substantially rectangular openings 14*b* at the bottom serving as air inlet openings for dust-laden air which passes therethrough and through both folds of a somewhat butterfly shaped filter 16, thence passes along spaces adjacent the front and rear walls of box 2. Such spaces are provided by virtue of integrally molded ribs 17 extending from the front and rear walls along the four inner edges of box 2. The frame 14 is provided with an integral, central, downwardly extending piece 15 to permit easy grasping by the wearer to facilitate insertion or removal of the filter pad and frame in the box 2. Said front and rear wall spaces are in communication at the top portion of box 2.

In order to securely hold the margin of the filter supporting frame 14 and the contacting filter margin in dust-tight engagement while in the box 2, the integrally molded ribs 17 projecting from the inner, corner edges of box 2 contact the margin of filter 16, additionally, integrally molded lugs 18 are provided on opposite sides of the bottom end of the box 2 and which project inwardly toward each other to form yieldable stops to engage opposite bottom edges of the frame 14 and thus securely lock it in place with the filter and frame all the way in the box to insure a dust-tight seal and to prevent the possibility of accidental withdrawal.

An important feature of my invention is the specific construction of the filter box 2, particularly in making it of rubber so as to allow it to expand somewhat as the frame 14 and filter 16 are inserted therein. Because of the slight yieldability of the box 2 along the interior edges and opening thereof, there is assured an air-tight fit between the box 2 and margins of filter 16 as well as between the margins of the filter and supporting frame 14 to prevent accidental leakage of dust laden air directly into box 2 without first passing through filter 16.

Figure 6 shows a modification of the inhalation valve diaphragm support wherein a central rib portion or partition 2*b* is provided which has mounted, centrally thereof, a rubber rivet support 19 for detachably fastening the rubber diaphragm 8. Thus a single and central point of support is provided which further reduces the breathing resistance afforded by the diaphragm.

An outstanding disadvantage of conventional means for attaching a headband to the respirator mask is that as the headband is pulled more tightly, it tends to separate the cheek-engaging portions of the mask, therefore tends to allow air leakage therethrough in some instances. This is because the direction of the forces applied to straps 4 and rivets 5 is somewhat outwardly at an angle and in a direction tending to lift or separate the cheek-surrounding portions of the mask.

Figures 7 and 8 show a modification of the headband strap fasteners for eliminating the above mentioned tendency, and which, on the contrary, causes a tighter fit on the mask against the cheeks as the ends of headband strap 26 are pulled more tightly. Generally stated, by doubling back the ends of the headband strap upon themselves and applying a lateral arm to which the forces are applied when pulling the strap more tightly towards the back of the wearer's head, there is a tendency for the fasteners to rock in such direction as to push the cheek-engaging portions of the mask inwardly more tightly toward the face. More specifically, referring to the modifications shown in Figures 7 and 8 showing the fastener on one side (the other being alike) a female element 21 of a snap fastener which is attached to mask 1 has sandwiched between its outer and inner portions an open loop element 22 which has an opening at 22*a* through which the strap 26 may be slipped. The male element 23 of the snap fastener has sandwiched between its end portions a looped end portion 26*a* of the strap. It will be noted more clearly in Figure 8 that as the head strap 26, which is reversely looped back on itself, is pulled to the right, as viewed in this figure, the left side of element 22 will be pulled away from the face and in so doing will rock the male and female fastener assembly in a clockwise direction as viewed in Figure 8. This will cause the cheek-engaging portion 1*a* of

the mask to be pushed more forcefully against the cheeks. Therefore the harder the ends of strap **26** are pulled, the tighter the respirator mask will be forced against the cheeks to insure an air-tight fit. This effect is obtained principally because the forces applied to the ends of strap **26** are offset laterally outwardly of the fastening points of the snap fasteners.

Figures 9 and 10 show another modification of the reversely looped headband strap for applying forces laterally outwardly of the snap fasteners and in a manner so as to rock the snap fastener assembly in a direction to cause the face engaging portion of the mask to push more firmly against the cheeks of the wearer. In this modification, a male element **28** of the snap fastener is attached to the mask **1** and the female element **29** has sandwiched between its end portions a looped end portion **26***b* of the strap **26**, which strap **26** is looped back upon itself as indicated in Figure 10 and extended through a metal closed loop element **30** of rectangular outline. Therefore as the end of strap **26** is pulled against the rear of the wearer's head so as to apply a force toward the right as viewed in Figure 10, it will cause the loop portion **26***c* of the strap to reduce in size and finally such force will cause a counterclockwise turning movement of the male and female fastener assembly (**28** and **29**) and in so doing will push the cheek-engaging portion **1***a* of the mask more tightly against the cheeks to insure an airtight fit. It will be noted further that even if loop **26***c* were rotated in its own plane through an angle of 180° by accidental rotation of the female element, as might well happen, the pulling forces applied to the ends of strap **26** will still tend to turn the fastener assembly counterclockwise to effect a tighter engagement of the mask portion **1***a* with the cheeks of the wearer.

Figures 11 and 12 show a still further modification of the head strap detachable fastening means to insure a more air-tight fit as the strap is pulled more tightly against the cheeks of the wearer. Figure 12 actually shows the fastening assembly adjacent the right cheek of the wearer rather than the fastening attachment shown in Figure 11. The connections on both sides of the mask are the same as they are for the other modifications shown in Figures 7 to 10 inclusive. On each side of the mask, a pair of male snap fastener elements **31**, **32** are attached and a pair of corresponding female snap fastener elements **33** and **34** are attached to the end portions of strap **26** and are detachably secured to the male fastener elements **31** and **32**, respectively. As a pulling force is applied to the reversely looped strap **26** to the right, as viewed in Figure **12**, the fastener elements **31–33** will tend to rock in a clockwise direction and likewise the fastener elements **32–34** so as to force the cheek engaging portion **1***a* downwardly as viewed in Figure 12, that is, in a direction toward the right cheek, so as to further insure an air-tight fit.

It will be observed that in all the modifications shown in Figures 7 to 12 inclusive, the headband strap is detachably fastened, therefore may be easily applied to the mask, and at the same time the connections at the ends of the strap are such that they will tend to push the cheek engaging portions of the mask in a direction toward the cheeks, instead of away from them as in conventional masks, and in so doing will cause even greater air tightness of the fit as a consequence of greater pulling of the straps.

Thus it will be seen that I have provided a highly efficient one-piece respirator including a face piece and filter holding box of rubber or similar flexible material which provides a relatively simple and inexpensive one piece construction which eliminates the possibility of leakage between the respirator and box as occurs in conventional constructions and which can be easily taken apart and which may be easily washed or cleaned, also which provides an amazing increase in comfort and fit on the face of different wearers having different nose sizes and contours; furthermore I have provided a respirator including a self-aligning head band and face piece construction arranged to evenly distribute pressure along the margin of the face piece to provide a dust-tight fit about the nose, cheeks and chin of the wearer; furthermore I have provided a filter holding box of rubber as an integral portion of the face piece, instead of as a separate detachable piece, so that the box will yield as a consequence of insertion of a filter supporting frame and filter therein and align them and insure an air-tight or dust-tight fit along the margins of the box, filter and frame and in this manner assure that dust laden air will enter the respirator only through the inlet opening therefor after passing through the filter.

While I have illustrated and described an embodiment of my invention, it will be understood that this is by way of illustration only, and that various changes and modifications may be made within the contemplation of my invention and within the scope of the following claims.

I claim:

1. A respirator including a unitary face piece and filter holding box of flexible material integrally molded in one piece, the filter holding box being positioned forwardly and extending downwardly of said face piece in substantially the form of a triangular box with downwardly and outwardly sloping sidewalls and integral front and rear walls and an open base portion, a filter supporting frame having corresponding downwardly and outwardly sloping sidewalls and a filter pad of substantially butterfly shape folded over and supported thereon mounted in said box so that the edges of said pad will directly contact the inner surface of the sidewalls of said box and form a dust-tight fit therewith aided by the yieldability of the box and aligning functions of the flexible sidewalls thereof.

2. A respirator as recited in claim 1 wherein integral projections are molded on opposite side portions of the bottom of said filter box, which project inwardly toward each other so as to serve as stop elements for holding the filter supporting frame in place when inserted in the box.

3. A respirator comprising a face piece adapted to provide an air-tight fit about the nose, cheeks and chin of the wearer and being of resilient material, integrally molded with a filter box of the same material, said box positioned forwardly and extending downwardly from said face piece and having closed side walls, front wall, and rear wall, and an open bottom wall, a filter and supporting element therefor mounted in said box so that the edges of the filter will form a dust-tight fit with the inner surface of said side walls, the side walls of said box being stretchable as a consequence of insertion of said filter and support element to provide an air-tight fit, an integral vertical partition between said face piece and filter box and having a central air inlet opening, and a thin flexible diaphragm supported on opposite side portions of the partition and covering said opening, the edges of said diaphragm forming an air-tight seal with the marginal portion of the partition surrounding said opening to form an inhalation valve.

4. A respirator as recited in claim 3 wherein said face piece has an integral bottom wall, also of flexible material, with outlet port means formed therein and rubber diaphragm means cooperating therewith to provide exhalation valve means.

5. A respirator as recited in claim 1 wherein said frame has a central, downwardly extending integral piece on the bottom edge thereof to enable easy grasping by the operator to facilitate removal of the frame and filter.

6. A respirator comprising a face piece and filter holding box of rubber-like material, integrally molded in one piece, said box being disposed forwardly and extending downwardly of said face piece and being substantially triangular, said box having closed yieldable sidewalls

and an open bottom wall, a removable filter and filter supporting frame having a corresponding triangular shape and fitted in said box in a manner so that the edges of said pad will form a dust-tight fit with the inner surface of said sidewalls so as to provide a yieldable dust-tight fit along the inside edges and mouth of said box.

7. In combination with a respirator mask having a mouth portion for surrounding and engaging the nose, cheeks and chin of the wearer in an air-tight manner, snap fastener elements attached to opposite sides of the mask, a headband strap having corresponding snap fastener elements at the end portions thereof, the end portions of said headband strap being looped back upon themselves, forwardly of said fastener elements so as to extend outwardly away from said snap fastener elements, whereby pulling forces applied by the headband strap will tend to push the cheek engaging portions of the mask toward the face of the wearer.

8. The combination as recited in claim 7 together with rigid loop elements, one on each side of the mask, through which the end portions of said headband strap are passed.

9. The combination as recited in claim 7 together with a pair of closed loop elements, one on each side of the mask, each having one portion which is looped by the extreme end of the strap and a parallel portion through which a portion adjoining the end of the strap is looped, whereby pulling of the headband toward the back of the head of the wearer will tend to turn the fastening elements in a direction so as to effect tighter engagement of the mask with the cheeks of the wearer.

10. The combination as recited in claim 7 wherein said snap fastener elements comprise a pair of elements in side-by-side relationship on the mask along the same direction as the straps and a pair of corresponding fastener elements attached to the end portions of the straps for detachable fastening with said first mentioned snap fastener elements, and wherein the end portions of the strap are doubled back forwardly of said elements and extend outwardly alongside all of said snap fastener elements, whereby rearward pull of the strap will tend to cause the snap fastener elements to turn in a direction so as to effect tighter contact between the mask and cheeks of the wearer.

11. A one piece respirator comprising a face piece of substantially triangular, cup-like configuration shaped to provide an air tight seal around the nose, mouth and chin of the wearer and a filter holding box of substantially triangular outline and of flexible material integrally molded with and forwardly of said face piece, two sidewalls of said filter holding box being completely closed and formed of said flexible material and extending downwardly and outwardly from a point below the top of the face piece, there being only one opening at the base of said box for insertion of a filter assembly, said filter holding box having an integrally molded rear wall, also of flexible material, forming substantially a continuation of the front wall of said face piece and having an opening, and an inhalation valve mounted on said opening.

12. A respirator as recited in claim 11 wherein said flexible material is rubber and wherein said rear wall has a lateral integrally molded extension, also of rubber, forming the bottom wall of the respirator and including exhalation valve means.

13. A respirator as recited in claim 11 wherein said filter holding box rear wall has integrally formed therewith a laterally and rearwardly extending bottom wall having integrally molded exhalation valve seat means.

14. A respirator comprising a face piece adapted to be fitted over the nose, mouth and chin of the wearer, an arcuate portion of substantially reduced thickness being integrally formed in the nose surrounding portion of said face piece, a substantially triangular filter holding housing forwardly of said face piece and having a rounded top portion and completely closed side portions extending downwardly and outwardly, said filter holding housing and face piece being made of flexible, elastic material integrally molded in one piece, said filter holding housing having an integrally molded rear wall with an inhalation valve opening and integrally molded valve seat of substantially triangular shape, a correspondingly shaped flexible valve sheet, stud means projecting from the rear surface of said rear wall and supporting said sheet over said valve seat, and a substantially triangular filter holding frame and filter inserted through an opening in the bottom of said filter holding housing.

15. A respirator as recited in claim 14 wherein said face piece includes a bottom wall integrally molded with, and extending laterally and rearwardly of, said rear wall of the filter holding housing and having a pair of integrally molded exhalation valve seats for seating a pair of exhalation valves, said bottom wall also being of flexible material.

16. A respirator comprising a substantially cup-shaped face piece of such configuration that its mouth portion is adapted to fit in an air-tight manner about the nose, cheeks and chin of the wearer, said face piece having a top portion which extends downwardly and angularly forwardly and terminates in a vertically downwardly extending integrally formed filter holder housing comprising front, rear and completely closed side walls integrally molded as one piece and being of flexible, elastic material and having a filter receiving opening only at the bottom of said filter holder housing, said rear wall forming an integral continuation of said face piece, in combination with a filter supporting frame having sides closely fitted to said side walls, and a filter draped about said frame and mounted within said filter holder housing so as to form an air-tight seat about the base portion of said filter holder housing, said base portion and side walls of the housing adapted to be stretched as a consequence of insertion of said frame and filter to insure an air-tight seal between the filter holder housing filter and frame.

17. A respirator as recited in claim 16 wherein said rear wall of the filter holding housing has an opening and an inhalation valve mounted over said opening, said rear wall having an integrally molded rearward extension forming the bottom wall of the face piece and having integrally molded therein exhalation valve seat means, and flexible exhalation valves mounted on said valve seat means.

18. A respirator comprising a face piece of substantially triangular and cup-shape having integrally molded therewith a filter holder housing of flexible material and of similar shape but of small dimension, the top portion of the filter holder housing being disposed below the top portion of the face piece, said housing having downwardly and outwardly extending closed side walls and an open bottom wall, said housing having ridges integrally molded on the internal surfaces thereof for spacing the filter from the housing walls throughout substantially the entire length of the filter, means for holding a detachable filter unit within said housing.

19. A respirator comprising a one piece, integrally molded face piece and filter holder housing of rubber-like elastic material, the housing projecting forwardly of the face piece and having downwardly and outwardly disposed, completely close side walls, an integral rear wall forming substantially a continuation of the front wall of said face piece and an open bottom wall for receiving a filter and filter holding frame, said face piece being substantially cup-shaped and of substantially triangular outline and having a marginal portion at the mouth thereof which is substantially reduced in thickness at the periphery of the face piece to provide a very yieldable, cushioned, air-tight fit on the face of the wearer.

20. A respirator including a unitary face piece and filter holding box of flexible material integrally molded in one piece, the filter holding box being positioned for-

wardly and extending downwardly of said face piece in substantially the form of a triangular box with an open base portion and having front, rear and sidewalls, a filter supporting frame and filter pad supported thereon and mounted in said box so that said pad will directly contact the inner surface of the sidewalls of said box and form a dust-tight fit therewith aided by the yieldability of the box and aligning functions of the flexible sidewalls thereof, and integral rubber ribs formed along the inside edges of front and rear walls of the box to provide a seal with the margins of the filter pad and to provide a space between the filter paid and said walls of the box.

21. A respirator as recited in claim 8 together with integrally molded lugs on the bottom ends of said sidewalls for engaging the bottom of said frame to lock the frame in place when it is inserted in the box with sufficient wedging action so as to provide an air-tight seal between the perimeter of the filter and said side sidewalls.

22. A respirator comprising a face piece of resilient material of substantially cup shape having a marginal portion adapted to surround the nose, cheeks and chin of the wearer, and having a pleated portion extending across the nose piece and terminating at points at opposite sides of the nose piece such as to give an accordion effect and to allow said marginal portion surrounding

the nose to pivot forwardly, as the result of collapsing movement of the pleated portion, at an angle with respect to the remainder of said marginal portion, thereby providing a yieldable, cushioned fit between the respirator and the face of the wearer, particularly about the nose, and having an integral, substantially triangular, filter housing portion extending forwardly and downwardly thereof with sides substantially parallel to those of the face piece, the side walls of said filter housing being completely closed and outwardly flexible so as to provide a yieldable but tight fit with the sides of a filter holding frame inserted in said housing.

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