March 20, 1945. W. H. LEHMBERG 2,371,965

RESPIRATOR

Filed Nov. 3, 1941

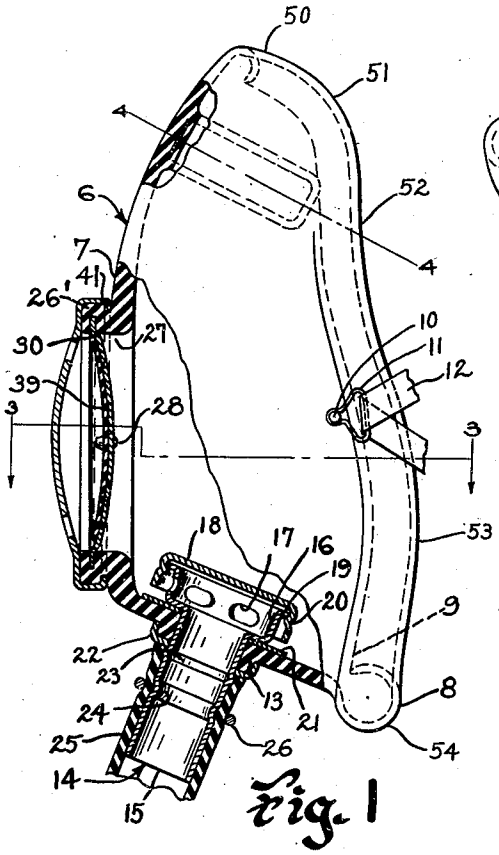


Fig. 1

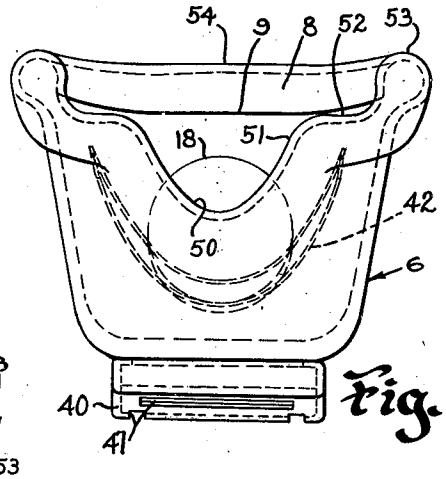


Fig. 2

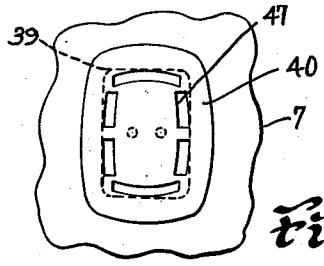


Fig. 5

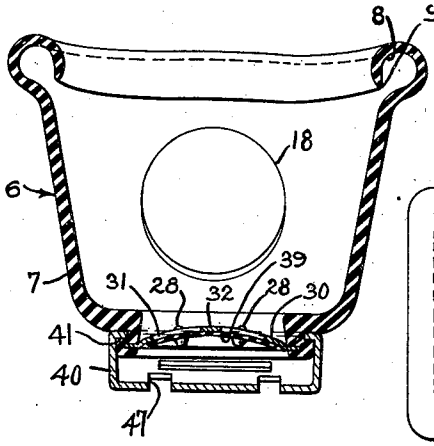
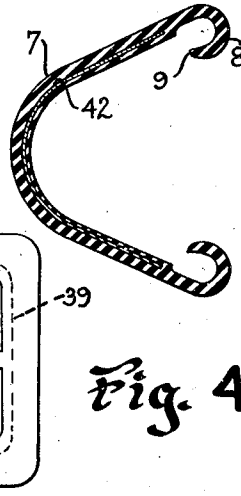


Fig. 3



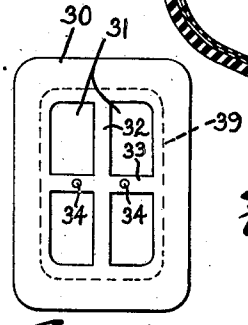


Fig. 4

Fig. 6

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RESPIRATOR

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3 Claims. (Cl. 128—146)

This invention pertains to respirators and more particularly to a supplied-air respirator which employs an air line connected to the face mask having an exhalator valve to permit the egress of air.

An object of the present invention is to provide a novel respirator of the supplied-air type having a face mask which is form fitting about the nose, cheeks, and under the chin of the wearer with a face engaging portion having a rolled edge of ductile material such as rubber.

It is a further object of the invention to provide a respirator with a connecting hose coupling which has a deflector or baffle to permit the air coming through the connecting hose coupling to be deflected downwardly and away from the face of the wearer at its entrance point in the face mask.

A further object of the invention is to provide a ductile metallic member embedded within a portion of the face mask to provide a degree of rigidity in the area of the nose fitting portion and permit shaping of the ductile metallic member for form fitting the mask in the region of the nose and cheeks.

A further object of the invention is to provide a respirator having a preshaped valve seat so that the diaphragm will have a natural curve therein to afford a more positive seating of the valve on the valve seat.

A further object of the invention is to provide a novel means and method of securing the valve and valve cover to the face mask.

Further and other objects may be and may become apparent to one skilled in the art from a perusal of the drawing and specification. While the present disclosure shows a certain specific structure, it is to be understood this is shown by way of illustration only, and changes may be made in the device without departing from the spirit of the invention as set forth in the subjoined claims.

In the drawing:

Fig. 1 is a side view of a respirator, partly broken away to show the arrangement of parts.

Fig. 2 is a top view showing the general curved outline of the face contacting portion of the respirator.

Fig. 3 is a sectional view taken along lines 3—3 of Fig. 1.

Fig. 4 is a sectional view taken along lines 4—4 of Fig. 1 showing the ductile metallic member embedded within the rubber of the face mask.

Fig. 5 is a reduced front view of the valve guard with the diaphragm shown dotted.

Fig. 6 is a front view of the exhalator valve seat.

Referring to the drawing and more particularly to Fig. 1, the respirator 6 comprises a rubber mask portion 7 having an inwardly rolled pliable lip 8 with the inner edge 9 being curved inwardly to form a rolled lip or face contacting portion. The inner edge 9 is spaced from the interior surface of the mask proper so that when the face mask is in position for use on a wearer, the lip 8 would yield somewhat to more readily assume the outline of the face when the mask is drawn into position by the head band 12.

A stud 10 has a head thereon so that the clip 11 may fit thereover holding the head band 12 in proper pivotal position, said head band being slidably adjustable in a loop portion of the clip 11. One of the studs 10 is located on either side of the face mask and is secured thereto. While a complete head band is not shown, it is to be understood that any suitable material may be used such as rubber or elastic. Any suitable head band may be used which permits the respirator to be properly held in position when in use. The clip 11 which fits below the head of the stud 10 is loosely connected to the stud and is pivotal thereabout so that the head band may be adjustable. The particular head band shown here consists of a looped piece of rubber which is fastened to either side of the face mask so that when in use there will be a tension in two directions rather than as in a one-piece head band as is frequently used in this type of respirator. The lower portion of the face mask has an opening therein with a circular shoulder 13 molded as part of the mask proper. A connecting hose coupling 14 has a tubular portion 15 which fits through the hole in the lower portion of the face mask. The upper end of the tubular member 15 has a cupped portion 16 with several holes 17 located therein. A deflector cap 18 fits over the cupped portion 16 and has several impressions 20 which fit over the lip 19 on the cupped portion 16 and hold the deflector cap 18 thereagainst. The lower portion of the deflector cap 18 is spaced from the cupped portion 16 so that the inflow of air may pass through the opening 17 and be deflected by the sides of the cap 18. A washer 21 engages the underneath portion of the cupped member 16 and has a cup-like washer 22 which fits over the shoulder 13 around the hole on the outside bottom portion of the face mask. A rib 23 has an outside diameter which is larger than the inside diameter of the cup washer 22 so that the rib 23 prevents the cup washer 22 from moving down-

wardly, thereby locking the connecting hose coupling in position on the lower portion of the face mask. The rib 23 may be formed by inserting a metallic plug in the tubular portion 15 before the deflector cap is placed in position. A rubber punch may be struck against the metallic plug inserted in the tubular portion of the coupling and the expanding rubber punch will force the tubular member outwardly so that the expanded metal portion results in the rib 23.

A groove 24 is formed in the tubular member below the rib 23. When the breathing tube 25 is placed in position, a ring 26 is placed on the outside of the tube 25 over the groove 24 so that the ring 26 may be squeezed and securely bind the rubber tube to the connecting hose coupling.

The connecting hose coupling 14 has the cupped portion 16 with a series of holes 17 in the sides of the cupped portion 16. The holes 17 do not go all the way around the cupped portion 16 since the rear wall is unperforated thereby preventing the downward flow of air to the rear of the coupling. About one-quarter of the circumference of the cupped portion 16 is unperforated while the holes are spaced around the other three-quarters of the cupped member to permit air to come through the sides and front of the cupped portion 16 but not to come through the rear.

The front of the mask 7 has a raised collar 26 all around the hole 27 in the front portion of the face mask. The shoulder 26' is molded as a part of the mask and has two grooves formed therein, one of the grooves being formed on the inside of the shoulder and the other being formed on the outside of the shoulder, both of the grooves completely going around the shoulder.

A valve seat 30, more clearly shown in Fig. 6 has four openings 31 located therein with a vertical rib 32 and a cross rib 33. Two perforations 34 receive pins 28 which secure the rubber diaphragm 39 to the valve seat 30. The diaphragm 39 is more clearly shown in dotted outline in Fig. 6. The ribs 32 and 33 are curved and the diaphragm is secured to the cross rib 33. By having curved ribs, the valve seat is cupped so that the diaphragm 39 also becomes cupped. When the diaphragm is properly pinned in position on the valve seat, the natural tendency of the rubber diaphragm to straighten out will cause the diaphragm to cover and positively seat against the openings 31 in the valve seat. When the air is coming through the valve seat, the diaphragm 39 raises up on the top and bottom edges to permit the air to flow. The valve guard or cover 40 is shown somewhat reduced in size in Fig. 5. Openings 47 in the cover permit the air to flow in a predetermined directional path therethrough when the device is in operation. The cover has a flange 41 all around the inner edge so that the flange may fit into the outside annular groove of the shoulder 26 and be securely held in place.

Fig. 4 shows the metallic strip 42 as being inserted within the face mask 7. The metallic member 42 may be of any suitable material that is pliable and shape retaining after it has been pressed together or expanded as the case may be. The purpose of the metallic strip is to permit a variance in the contour of the lip 8 in the area of the nose and the upper portion of the cheek. While a degree of variance may only be required in certain cases, it is desirable to provide a more definite fit for the particular individual using the respirator. Further, the embedding of the metallic strip in the rubber keeps it obscure from both the outside and the inside of the mask. Since the metallic strip is an integral part of the face mask, the shape retaining function of the metallic strip is more effective because the rubber completely surrounds the metallic member. The metallic strip may be suspended in proper position between the molds when the rubber face mask is molded, or a recess can be formed in the proper location on the side of the mask and the metallic strip may thereafter be inserted in the recess and a rubber strip plug may be vulcanized in place over the metallic strip to secure it in position. Fig. 2 shows the metallic strip 42 dotted in position. Fig. 2 also shows the valve cover 40 properly secured to the mask and having openings 47 therein to permit the passage of air therethrough.

In operation, when pressure is applied through the tube or hose 25, the air flows through the holes 17 in the connecting hose coupling and against the deflector cap. The increased pressure within the face mask forces the edges of the diaphragm 39 away from the valve seat and the air flows through the holes 31 in the valve seat and out through the holes 47 in the valve cover 40. When the device is in use on the face of a wearer with pressure applied through the air hose, the diaphragm 39 is partially unseated at all times. The individual wearing the mask is then permitted to inspire respirable air supplied through the air hose without having a direct blast into the mouth or nostrils when the respirator is in use. The head band 12 securely holds the face mask in position on the face of the wearer and the rolled lip 8 forms a good seat for the face mask on the face and under the chin so that there is no appreciable leakage of air.

While the valve seat 30 has been set forth as being made of metal, it is to be understood that it may be made of any other suitable material such as fiber or plastic. The valve seat may be made of rubber and molded in place as an integral part of the rubber face mask portion.

From the foregoing, it will be seen that the curved valve seat deforms the diaphragm 39 so that there is always assured a good contact between the edges of the diaphragm and the valve seat. It will also be seen that there will be no direct air blast rearwardly from the connecting hose coupling.

The entire rubber portion of the face mask is molded into a unitary rubber portion having a hole in the lower portion thereof to receive the connecting hose portion and a hole in the front of the face mask to receive the exhalation valve seat and the valve cover. In this unitary structure of rubber, there is embedded the metallic strip to assure a better shaping for individual use. The rubber structure also embraces the rolled lip 8 which is thinned out near the edge 9 thereof so that the rolled lip 8 will be readily yieldable when pressed against the face and chin by the tension of the head band 12.

While the valve seat has been set forth as being made of metal having ribs 32 and 33, it is to be understood that the valve seat may be formed as an integral part of the face mask with said ribs or the equivalent thereof being made of rubber. The thickness of the rubber ribs may be sufficient to permit a curve to be molded on the front walls of the ribs so that a positive seating action of the valve per se will function substantially as set forth hereinbefore.

Regarding the face piece, it is desirable that the face contacting portion of the cup-like member be made of resilient material and that the in-

wardly turned rolled edge be continuous about the peripheral edge of the cup-like member.

The upper or nasal portion 50 of the face piece is recessed and fits across or about the bridge of the nose and extends somewhat rearwardly and downwardly at 51 so that it contacts the sides of the nose and blends with slightly curved portions 52 which are shaped substantially to the contour of and to overlie the cheek bones at the side of the nose and thence extend slightly rearwardly and downwardly at 53 about the side area of the mouth portion, with the chin portion 54 thereof shaped to fit beneath and substantially to the shape of the under portion of the chin.

The face contacting portion may be formed integrally with the cup-like member having a continuous rolled edge about the periphery of the cup-like face piece, or the inwardly turned rolled edge, which is continuous about the face piece for engaging the face of the wearer may be made independently and cemented or vulcanized thereon, or may be sewed or secured to the cup-like face piece depending upon the type of material employed for making the cup-like portion of the face piece.

Having described my invention, I claim:

1. In a device of the character described a hollow cup-like member formed of resilient material having an inhalation opening and an exhalation opening therein, said cup-like member, outwardly of the exhalation and inhalation openings having integral protruding collar portions surrounding said openings, said inhalation opening having a tubular member extending therethrough, said tubular member, inwardly of the cup-like member, having an enlarged portion with a bottom wall overlying the portion of the cup-like member adjacent the inhalation opening, said enlarged portion having perforated side walls and a flared open end portion, a cap fitting over said flared end portion with side walls extending over and spaced from the perforated walls of said enlarged portion, the side walls of said cap having a plurality of indentured portions engaging the flared end of the enlarged portion to secure said cap in position thereon, an annular member on said tubular member outwardly of said cup-like member, said annular member overlying the collar surrounding the inhalation opening and means on said tubular member for securing said annular member in position with said tubular member projecting outwardly to receive an air line connection.

2. In a device of the character described a hollow cup-like member formed of resilient material having an inhalation opening and an exhalation opening therein, said cup-like member, outwardly of the exhalation and inhalation openings having integral protruding collar portions surrounding said openings, said collar portion surrounding the exhalation opening having an inner groove, a valve support secured throughout its periphery in said groove and a perforated cover plate having a circumferential flange fitting over said collar for retaining the valve support in said groove and said inhalation opening having a tubular member extending therethrough, said tubular member, inwardly of the cup-like member, having an enlarged portion with a bottom wall overlying the portion of the cup-like member adjacent the inhalation opening, said enlarged portion having perforated side walls and a flared open end portion, a cap fitting over said flared end portion with side walls extending over and spaced from the perforated walls of said enlarged portion, the side walls of said cap having a plurality of indentured portions engaging the flared end of the enlarged portion to secure said cap in position thereon, an annular member on said tubular member outwardly of said cup-like member, said annular member overlying the collar surrounding the inhalation opening and means on said tubular member for securing said annular member in position with said tubular member projecting outwardly to receive an air line connection.

3. In a device of the character described a hollow cup-like member formed of resilient material having an inhalation opening and an exhalation opening therein, said cup-like member, outwardly of the exhalation and inhalation openings having integral protruding collar portions surrounding said openings, said inhalation opening having a tubular member extending therethrough, said tubular member, inwardly of the cup-like member, having an enlarged portion with a bottom wall overlying the portion of the cup-like member adjacent the inhalation opening, said enlarged portion having perforated side walls and a flared open end portion, a cap fitting over said flared end portion with side walls extending over and spaced from the perforated walls of said enlarged portion, the side walls of said cap having a plurality of indentured portions engaging the flared end of the enlarged portion to secure said cap in position thereon, an annular member on said tubular member outwardly of said cup-like member, said annular member overlying the collar surrounding the inhalation opening and said tubular member having outwardly extending means engaging said annular member for securing said member in position.

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