June 18, 1935. L. Y. BOOHARIN 2,005,072

BREATHING MASK

Filed Oct. 15, 1934

FIG. 1.

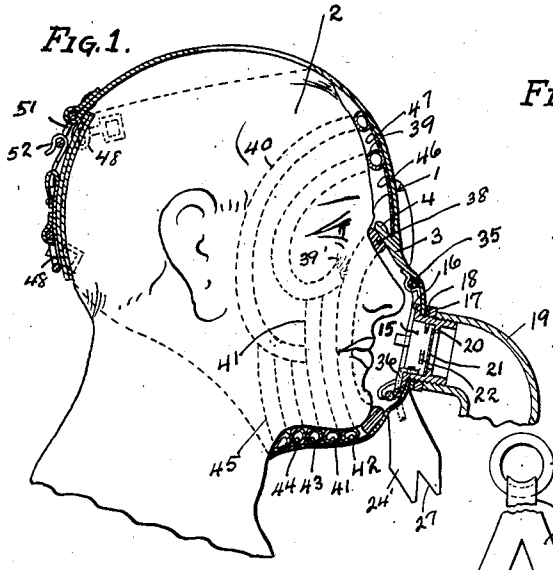


FIG. 2.

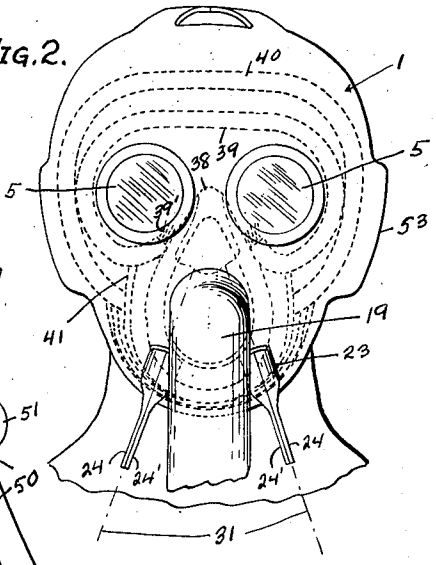


FIG. 3.

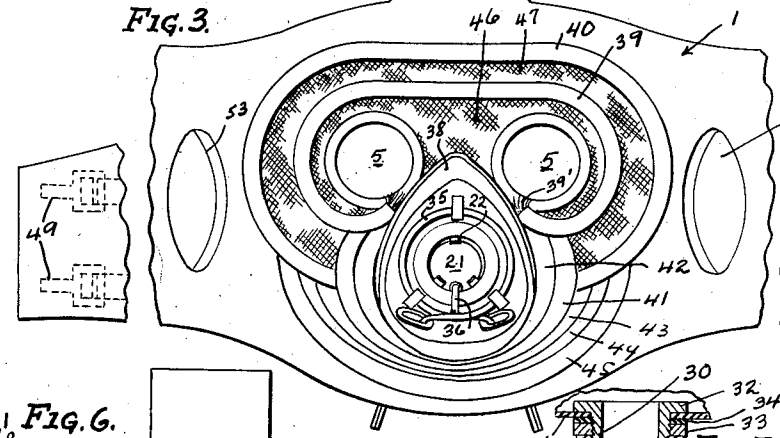


FIG. 6.

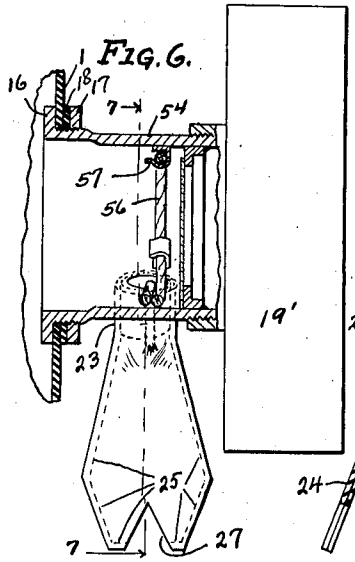


FIG. 7.

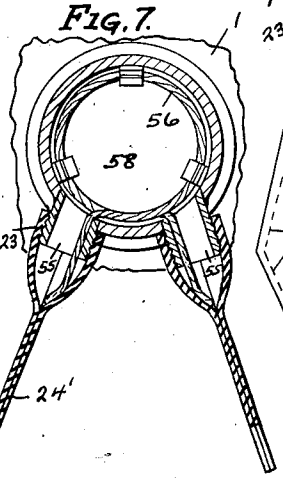


FIG. 5.

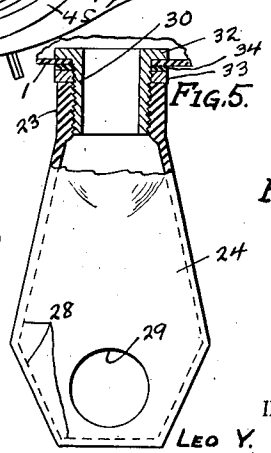
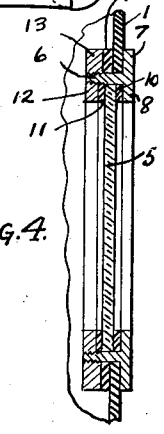


FIG. 4.



INVENTOR.
LEO Y. BOOHARIN
BY
Miller Boyken & Reed
ATTORNEYS.

Patented June 18, 1935 2,005,072

UNITED STATES PATENT OFFICE

2,005,072

BREATHING MASK

Leo Y. Booharin, San Francisco, Calif., assignor of one-third to William H. Lea and one-third to Bertram Werner

Application October 15, 1934, Serial No. 748,335

16 Claims. (Cl. 128—141)

This invention relates to masks as used to promote healthful breathing in contaminated atmospheres, either dust or chemical laden, or carrying poisonous gases.

The objects of the invention are to provide a mask that is relatively light, cheap to make and one that will insure against ingress of gases or dust to the nose, mouth and eyes of the wearer without injury to the skin along the lines of seal. Other objects are a construction in which the various elements of the mask, such as exhaust valves and eyepieces, are replaceable, and in which the mask is readily adapted to any condition that may exist in the atmosphere.

Other objects and advantages will appear in the following specification.

In the drawing, Fig. 1 is a vertical section through my mask with the head of the wearer shown in elevation.

Fig. 2 is a front elevation of the mask on a wearer.

Fig. 3 is a view in elevation of the interior construction of the mask when slightly opened out.

Fig. 4 is an enlarged sectional view through one of the eyepieces and its mounting.

Fig. 5 is an enlarged view of one form of exhaust valve showing the means for attaching to the mask in section. The portion shown in section is common to any of the valves adapted for attachment to the mask body.

Fig. 6 is an enlarged sectional view of one of the attachments adapted for use with the mask in which exhaust valves are on the attachment instead of being on the mask body direct.

Fig. 7 is a sectional view of Fig. 6 as seen along the line 7—7 thereof.

In detail my mask comprises a body 1 of relatively soft gum rubber in the form of a relatively wide, elongated belt with its central portion molded to form a mask cavity generally conforming to the contour of the face of a wearer 2 with a nose portion 3 inwardly formed with an arched bridge member 4 at its upper end adapted to extend across the bridge of the wearer's nose.

The face portion of the mask has a pair of circular openings for circular glass eye pieces 5, and a circular opening is provided in the portion of the mask over the mouth of the wearer.

The eyepieces respectively are removably mounted in the eye openings in short cylindrical, tubular members 6, which are outwardly flanged at 7 to engage against the outside of the mask around the eye openings, the tubular portion 6 extending through the openings to inside the mask cavity, all of which is best shown in Fig. 4. A radially inwardly extending flange 8 is formed at the same end of member 6 as the flange 7.

The tubular member 6 is exteriorly and interiorly threaded at the end opposite the flanges and annular rubber washers 10, 11 are disposed on opposite sides of the eyepiece at its margins, the washer 10 engaging flange 8 and the washer 11 being engaged by a nut 12 screwed into the threaded end of the member 6, thus securing the lens 5 in place and sealing it at the margins against leakage of gas or objectionable dust. The member 6 is secured in the mask openings by a nut 13 that is screwed onto the outer threads of said member and a washer 14 is between each nut and the margins of the mask openings so that upon tightening nut 13 the mask is gripped between flange 7 and the nut.

The foregoing construction provides for easy removal of the eyepiece or lens 5 for substitution of glass for mica or vice versa, or for replacing a broken or damaged eyepiece.

Within the opening over the mouth of the wearer is secured means for attaching a hose line, or can of chemicals for purifying the air, or a dust collector, as may be desired. Fig. 1 best illustrates the preferred type of mounting for such attachments. This mounting comprises a short tube 15 outwardly flanged at one end 16. The tube extends through the mask opening from the inside with the flange engaging the inside of the mask around the opening. Tube 15 is exteriorly threaded at the end opposite the flange for engagement by a nut 17 for securing the edge of the mask between the flange and nut, a washer 18 being first interposed between the nut and mask. Outwardly of the nut 17, the same threads as engage the nut are adapted to engage a suitable attachment, such as 19, which attachment in turn connects with a hose line. Or an attachment such as 19' in Fig. 6, may be substituted or other attachments such as those of the Y-shaped type for two hose lines.

Inside tube 15 is an annular flange or ring 20 that forms a seat for the margin of a loose valve disk 21 of mica or other light sheet material. Lugs 22 projecting inwardly of the tube on the side of the disk opposite ring 20 limit the movement of the valve upon inhalations, and permit passage of air upon such inhalations around the edge of the disk, the diameter of the disk being smaller than the diameter of the bore of the tube.

From the foregoing, it is obvious that the construction I provide permits the use of any desired type of filtering device, and permits quick change

from one to the other. This is convenient in all cases and very essential in some, where it is necessary to quickly change from one type of gas filter to another upon sudden changes in atmospheric conditions.

To care for the exhalations of the wearer, I provide two short, cylindrical tubes **23** of gum rubber, each being extended at one end in the form of opposed flattened strips **24, 24'** disposed with their sides together, thus forming complete valves that permit exhalations but prevent inhalations. The edges of the flattened ends of each valve are connected together securely along dotted lines **25** (Fig. 6) and the lower or outer end of the valves are cut in the form of an inverted V as at **27**. The edges of the strips along the V are not secured together, or, as shown in Fig. 5, all of the edges of the strips may be secured together as at **28**, and then one or both of the strips are apertured at **29**. The exhaled air passes out of the valve through these disconnected edges.

The valves are mounted on relatively short tubes **30** (Fig. 5) extending through and aligned in openings in the mask on either side of the mouth, which openings are respectively disposed substantially beneath each of the nostrils of the wearer and substantially in the lines of discharge of exhaled air from the two nostrils, as indicated by dotted lines **31**, (Fig. 2). The tubes **30** are flanged outwardly at one end inside the mask cavity as at **32**, (Fig. 5) and the outer end of each of the tubes is exteriorly threaded for engagement of a nut **33**. A washer **34** is interposed between the nut and mask body so that upon tightening the nut the mask is gripped between the washer and flange. The end **23** of the valve is adapted to be stretched over the threaded end of tube **30**, making a tight fit, and it is then screwed up tight against the nut. This portion **23** of the valve is relatively heavy compared to the flattened ends **24, 24'** thus adding strength and also providing a tighter fit of the valve on the tube.

With the valves disposed as above described, they open readily under the exhalations of the wearer, since the direct force of the breath goes into the open ends of the valves without initial deflection. In ordinary valve construction, the passage of air through the valves would cause a vibration of the flat sides at the edges of the openings, but after extensive experiments, I have found that by providing the inverted V-shaped end of the flat strips as in Fig. 6, or by connecting all edges of the flat sides as in Fig. 5 and perforating one or both of the flat sides, it is impossible to set up a vibration and the valves operate without any noise whatsoever. This is a very important feature, since if the side edges of the valves are opened or the end is straight or curved, and open, the valve will make a buzzing noise upon breathing. The effect of this in wartime, where hundreds of men are using masks, is highly objectionable.

By the screw construction of the valve in its attachment to tube **30** and by the construction for mounting tube **30** on the mask, it is possible to quickly and easily change valves, should they become injured.

In the operation of the valves, I have found that it is very desirable to supply a uniform amount of moisture between the flattened ends of the valve and yet to prevent excessive moisture passing therethrough at intervals. If the valves are not kept uniformly moist they tend to stick, and if a sudden stream of moisture passes to the valves they will admit gas to the interior of the mask.

In my mask I provide a strip of absorbent material **35**, such as a wick, around the inside of the mask cavity adjacent the mouth opening in which the member **15** is mounted, (Figs. 1 and 3). The opposite ends of the wick cross at the bottom and pass into each of the valves respectively for about a third of the length of the valves, and a short wick **36** connects with wick **35** and extends into member **15** a short distance to take moisture from the disk **21** and the inside of tube **15** and to convey such moisture to wick **35** for draining into the valves. The upper ends of the valves form a sump into which the wick drains.

By this arrangement, not only is the interior of the mask kept clear of moisture, but the valves are provided with a steady, uniform flow of moisture to facilitate their operation. Also the wick **36** prevents moisture from flowing into a chemical container beyond the disk **21**. Even if my mask is laid aside for from a few minutes to a half hour, the moisture in the wick is sufficient to keep the valves lubricated, where in other masks the valves are stuck tightly together. The moisture, of course, is wholly supplied from that coming from the breath of the wearer.

Another important feature of my mask is the construction I use for sealing the mask with the face to prevent ingress of gas to the eye, nose and mouth cavities.

Heretofore it has been customary to use a single strip of tubing around the edge of the mask, but in such cases the mask must be very tightly pulled against the face to accommodate the strip to the irregularities of different physical facial characteristics. To avoid this, certain masks use wide strips of soft padding. This prevents the circulation of any air to large areas of skin and soon the skin becomes chafed and sore, due to the tendency of the skin to perspire.

In my mask I provide an arrangement of relatively narrow tubing or relatively narrow strips of soft rubber so positioned as to effectively seal the nose, eyes and mouth from gas and yet to permit the maximum area of skin to be exposed to air, even though such air is confined against circulation to the outside atmosphere.

This arrangement comprises a strip of soft rubber **38** extending over the bridge of the nose, down the sides of the face adjacent the corners of the mouth and along and in front of the chin. Extending across the forehead of the wearer is a tube **39** of soft rubber which continues around the outer sides of the opposite eyes and curves under the eyes to meet strip **38** at a point under the inner corners of the eyes. Spaced from tube **39** is a second tube **40** generally following the curvature of tube **39**, which tube **40** engages at its opposite ends with one tube **41** of a pair of tubes that extend under the chin of the wearer and along the sides of the face, the inner or forward one of this pair of tubes being numbered **42**. The tubes **41, 42**, engage at their upper ends with tube **39** under the wearer's eyes. Parallel with tubes **41, 42** and passing under the chin and throat of the wearer are tubes **43, 44, 45**, which tubes connect at their opposite ends with tube **40**.

By the above construction, all tubes being secured to the mask by cement or other suitable means, I provide a system in which the tubes are individually free to conform to irregularities in the contour of the face of the wearer, and air spaces are left between the lines of contact of the tubes with the face. Thus, it is possible to seal

the mask cavity against ingress of gas without excessive tightness of certain parts for insuring the seal, since the tubes will independently adapt themselves to irregularities. Of course, soft rubber strips may be used instead of tubes, such as sponge rubber, provided the outer surface of such strips is rendered impervious to passage of gas.

It will be noted that tube **39** is provided with a wick **39'** projecting from the ends thereof directly below the inner corners of the eyes. This is to catch and absorb moisture from the eyes, since the provision of a cushion across the bridge of the nose and down the sides of the nose sometimes excites the lachrymal glands, producing tears.

In actual use in all masks, considerable moisture is exuded from the skin of the forehead and around the eyes, particularly in hot weather or in heated rooms. This moisture is absorbed by a lining **46** of absorbent material on the inner surface of the mask between tubes **38** and **39**, and a similar absorbent lining **47** is provided between tubes **39** and **40**. This prevents drops from gathering in these areas, and where only several hours' use of the mask is required at a time, it prevents fogging of the eyepieces. This absorbent material is easily removed and replaced, or can be left in the mask to dry if desired.

The mask, as already stated, is formed from a belt of soft rubber, which belt passes at its ends over the ears, and the ends overlap behind the head. A pair of rings **48** are on one end of the belt and are adapted to engage a pair of hooks **49** on the other free end of the belt. A strap **50** extends from the portion of the belt over the forehead across the top of the head and is provided with a ring **51** adapted to engage a hook **52** secured to one end of the belt. Ear recesses **53** are formed in the opposite sides of the mask to accommodate the ears of the wearer and to permit the belt to lie flat against the head so that a further seal against ingress of gas to the mask cavity is provided.

In some instances it is found highly desirable to provide for additional exhaust tubes or valves, particularly where extremely heavy work is being done. This is readily accomplished with my mask by substituting for tubular member **15** a somewhat similar tubular member **54**, (Figs. 6, 7). This tubular member is provided with short tubes **55** projecting therefrom similar to the valves on the mask body. These tubes are exteriorly theaded to receive valves of the same kind as are provided on the mask. However, the interior of tube **54** is different from member **15** in that it is provided with a wick **56** secured by clips **57** to the inside of the tube therearound adjacent the inner side of the disk valve **58**, and the ends of the wick project into tubes **55** so as to drain into the valves. Even where extra valves are not absolutely necessary for proper breathing, this system of draining the tube connection **54** is found very desirable, hence the valves are necessary to provide for the drain. Of course, in some cases, the valves on the mask could be eliminated and these valves alone provide for exhalation of breath, although the valves on the mask are preferable due to their position relative to the nostrils of the wearer.

Having described my invention, I claim:

1. In a breathing mask provided with a body portion adapted to fit over the nose and mouth of the wearer, said body portion having an air intake and an exhaust tube, said air intake including a disk valve adapted to open upon inhalations of the wearer and to close upon exhalations, and a strip of moisture-absorbent material extending from a point adjacent the disk of the disk valve and into the exhaust tube for draining moisture into the exhaust tube.

2. In a breathing mask provided with a body portion adapted to fit over the nose and mouth of the wearer, including an air intake and an air exhaust tube, said exhaust tube comprising a tubular neck and a pair of rubber strips of flat, soft rubber extended from an end of said neck arranged and adapted to close upon inhalation of air, means for securing said exhaust tube to the body portion comprising a short tubular member flanged outwardly at one end and exteriorly threaded at the opposite end, said tubular member adapted to extend through an opening in the body portion with the flange adapted to engage the margins of the body portion adjacent such opening on the inner side of said portion and the neck of said exhaust tube adapted to threadedly engage the tubular member on the outer side of the mask.

3. In a construction as defined in claim 2, a nut adapted to engage the threads of said tubular member between the exhaust valve and outer side of the body portion adapted to tightly grip the body portion between said flange and nut upon tightening the nut.

4. A breathing mask comprising a body portion adapted to fit over the face and under the chin of the wearer, means spacing said body portion from the face and providing a sealing contact with the face comprising a relatively narrow strip of soft rubber adapted to extend across the bridge of the wearer's nose, down the sides of the face and across the forward point of the wearer's chin and a second relatively narrow soft rubber strip adapted to extend across the forehead of the wearer, down the sides of the face adjacent the outer corners of the eyes and under the eyes to connect with said first mentioned strip at points on the opposite sides of the wearer's nose beneath the inner corners of the wearer's eyes.

5. In a construction as defined in claim 4, said body portion being of material impervious to passage of gas, a pair of eyepieces on the body portion positioned over the eyes of the wearer and a moisture absorbent material on the inner side of the mask adjacent said eyepieces.

6. In a breathing mask comprising a mask adapted to fit over the face and under the chin of the wearer, means spacing said body from the face and providing a sealing contact with the face comprising a plurality of substantially parallel, relatively narrow, soft rubber strips extending transversely under the chin of the wearer and upwardly along the sides of the wearer's cheeks, a relatively narrow, soft rubber strip extending across the forehead and down the sides of the face adjacent the opposite eyes of the wearer respectively adapted to engage the strips extending under the chin of the wearer at their upper opposite ends.

7. In a breathing mask comprising a mask body adapted to fit over the face and under the chin of the wearer, means spacing said body from the face and providing a sealing contact with the face comprising a relatively narrow, soft rubber strip extending across the forehead and down the sides of the face adjacent the opposite eyes of the wearer respectively and under the eyes to opposite sides of the wearer's nose, a second rela-

tively narrow, soft rubber strip spaced outwardly from the first mentioned strip and substantially following the same general shape.

8. In a construction as defined in claim 7, said body being of material impervious to passage of gas, and a moisture absorbent material disposed on the inner side of the mask between said strips.

9. A gas mask comprising a body formed from a relatively wide rubber belt adapted to cover the face of the wearer and to extend across the ears to the rear of the wearer's head, said belt being centrally molded to provide a central cavity shaped to conform generally to the contour of the face of the wearer and a plurality of relatively narrow, soft rubber strips secured to the belt on the interior of said cavity arranged and adapted to space the cavity portion from the face of the wearer and arranged to provide a sealing contact with the wearer's face around the eyes, nose, mouth and chin of such wearer.

10. In a construction as defined in claim 9, said strips being formed with rounded surfaces on their sides opposite the sides thereof secured to the mask.

11. In a construction as defined in claim 9, said strips comprising soft rubber tubes.

12. In a breathing mask comprising a body portion adapted to fit over the eyes, nose and mouth of the wearer and provided with an inlet positioned over the portion thereof fitting over the wearer's mouth, a soft rubber strip projecting from the inner side of the mask arranged and adapted to form a seal against the face of the wearer, and to form a pair of independent non-communicating areas over the eyes of the wearer and over the nose and mouth of the wearer respectively between the wearer's face and inside surface of the mask.

13. In a breathing mask of the character described including a body portion adapted to fit over the nose and mouth of the wearer provided with an air inlet, an air exhaust valve comprising a tubular neck secured to the mask with its bore communicating with the inside of the mask and a pair of flattened rubber strips of similar outline and size extending downwardly from an end of said neck, said strips being connected along their opposite lateral edges from their lowermost ends to the tubular neck, the lower ends of the strips being formed with unsecured edges extending generally convergently upwardly from adjacent the secured side edges adapted to open upon exhalation of the breath of the wearer and to close upon inhalation.

14. In a breathing mask of the character described including a body portion adapted to fit over the nose and mouth of the wearer provided with an air inlet, an air exhaust valve comprising a tubular neck secured to the mask with its bore communicating with the inside of the mask and a pair of flattened rubber strips of similar outline and size extending downwardly from an end of said neck, said strips being connected along their opposite lateral edges from their lowermost ends to the tubular neck, the lower edges of the strips being of inverted V-shape and unsecured so as to open upon exhalations of the wearer and to close upon inhalations.

15. In a breathing mask of the character described including a body portion adapted to fit over the nose and mouth of the wearer provided with an air inlet, an air exhaust valve comprising a tubular neck secured to the mask with its bore communicating with the inside of the mask and a pair of flattened rubber strips extending downwardly from an end of said neck, said strips being connected along their opposite lateral edges from their lowermost ends to the tubular neck, the lower ends of the strips being formed with unsecured edges extending generally convergently upwardly from adjacent the secured side edges adapted to open upon exhalation of the breath of the wearer and to close upon inhalation, the connected lateral edges of the strips of the pair extending divergently downwardly from opposite sides of the tubular neck to points substantially opposite the uppermost point of the unsecured edges and said connected lateral edges continuing convergently downwardly from said points to the lowermost ends of the strips.

16. In a breathing mask of the character described comprising a body formed from a relatively wide rubber belt adapted to cover the face of the wearer and to extend over and across the wearer's ears to the back of the head, said belt being molded to provide a cavity shaped to conform generally to the contour of the face of the wearer and to provide an individual cavity adapted to receive each ear of the wearer, and means projecting inwardly from the inside of the face cavity adapted to engage the face of the wearer for spacing the inner side of the face cavity from the face of the wearer and to provide a seal against ingress of gas to the eyes, nose and mouth of the wearer.

LEO Y. BOOHARIN.