June 4, 1963 J. E. GABB 3,092,105

RESPIRATORY MASKS

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Fig. 1.

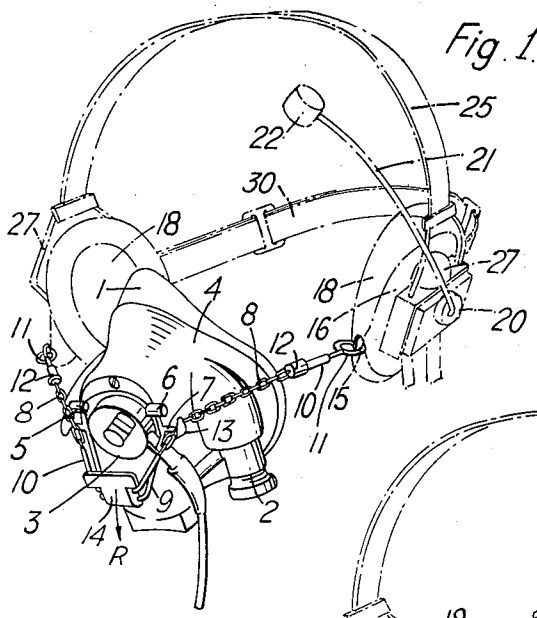


Fig. 2.

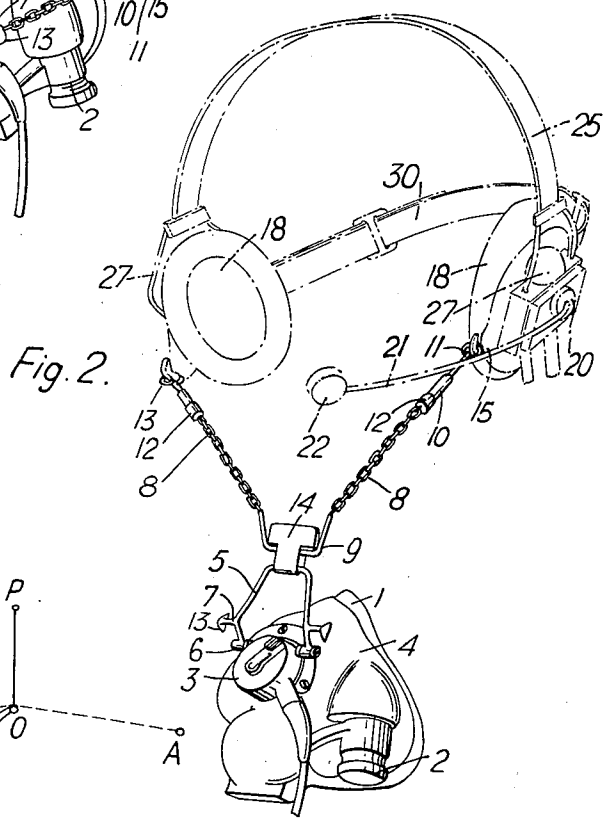
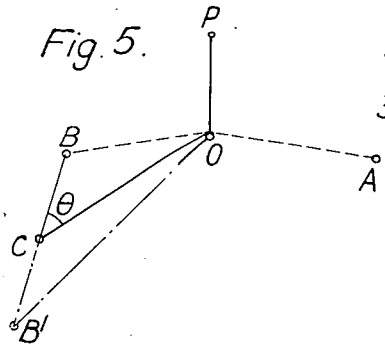


Fig. 5.



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Fig. 3.

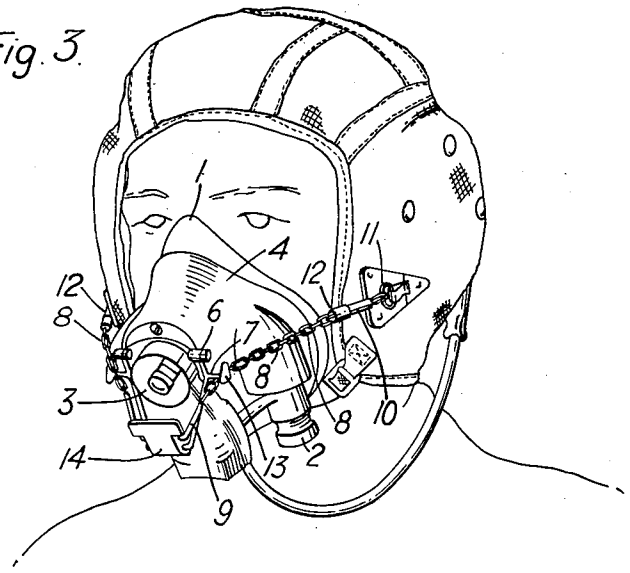
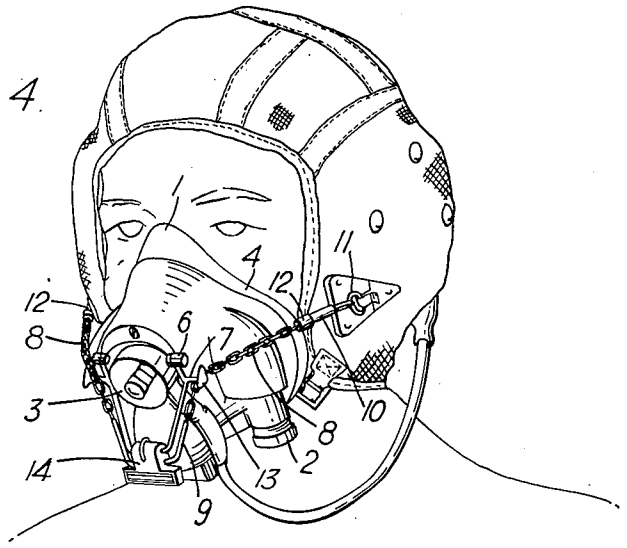


Fig. 4.



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3,092,105
RESPIRATORY MASKS

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This invention relates to respiratory masks, and particularly to the way in which the masks can be attached to a harness upon the head of the wearer so that they are held firmly against the face without any danger of leakage around the edges of the face-piece.

In a prior U.S. Patent No. 2,814,293, filed by the present applicant jointly with Avon Spurgin Lucking on February 14, 1955, there is described a mask provided at each side with a toggle composed of two pivoted links capable of holding a face-piece firmly against the face of the wearer with both links extending forwards from points of attachment respectively to the face-piece and to a support attached to the head of the wearer, relative movement of the link being limited by a stop which prevents breaking of the toggle by downward movement of the front of the links but allows the toggle to be broken by an initial upward movement of the front ends of the links.

When a person wearing the mask constructed as described in detail in the specification above referred to, wishes to remove the mask, he pushes the front ends of the links upwards sufficiently to break the toggle so that the mask drops from his face. The mask then hangs by the toggle links and rests on the wearer's chest. This is a convenient position but a disadvantage has been found in that there is a tendency for the hanging mask to interfere with thefree movement of the wearer's head owing to the lateral rigidity of the linkage. One object of the present invention is to overcome this disadvantage by making the linkage connecting the mask to the support flexible, so that it will permit lateral movement of the mask relatively to the wearer's head when the mask is hanging by the links.

A further object of the present invention is to provide positive stop means for limiting the downward movement of the forward ends of the links relatively to the mask thereby increasing the stability of the linkage when the mask is fitted to the face of the user. A still further object of the invention is to provide two fixed abutments, one on each side of the mask for the tension elements of the linkage to bear against when the mask is fitted to the face of the wearer, thereby providing fixed points of application of the forces applied to the mask by the tension elements for holding the mask in place on the face of the wearer.

Other objects and advantages will appear from the following more detailed description with reference to the accompanying drawings which illustrate a preferred embodiment of the invention and in which—

FIGURE 1 is a perspective view of the mask,

FIGURE 2 is a perspective view of the mask of FIGURE 1 hanging in the rest position,

FIGURE 3 is a perspective view of the mask attached to a helmet as the head support and in a first pressure position,

FIGURE 4 is a perspective view of the mask in the second pressure position, and

FIGURE 5 is a diagram illustrating the action of the linkage provided in accordance with the invention for securing the mask in position when fitted to the face of the user.

In the constructions shown in FIGURES 1, 2, 3 and 4 of the drawings, the breathing mask comprises a rubber or like face-piece 1 shaped to fit over the nose and mouth

of the wearer and a rigid backing member 4, which supports the face-piece and holds it in shape. The mask is provided with an attachment 2 for an oxygen pipe and a microphone 3. The breathing valves and internal arrangements of the mask form no part of the invention and are not illustrated.

The breathing mask is connected to a support attached to the head of the wearer by a linkage which includes a lever 5 pivotally attached to the backing member 4 of the mask by means of hinges 6 so that the lever can be swung up and down. The lever has two parallel arms attached to the hinges 6 at opposite sides of the mask as shown, each arm being cranked downwardly so that the angles 7 of the cranked arms abut against the front face of the member 4 when the lever is swung downwards in front of the mask. The lever is thus mounted for limited downward swinging movement, the front face of the mask 4 acting as a stop for limiting the downward swinging movement of the lever in the position shown in FIGURES 1 and 3 of the drawings.

The linkage above referred to further includes two flexible tension members one at each side of the mask for attaching the mask to the head support. Each flexible tension member comprises a chain 8, one end of which is attached to one arm of a U-shaped member 9 pivotally attached to the extremity of the lever 5 in a manner hereinafter to be described. The other end of each chain 8 is attached to an adjustable turn-buckle 10 at the other end of which is an eye 11 by which the tension links may be secured to the head support as hereinafter more fully described. The turn-buckles 10 can be adjusted to regulate the tension members of the linkage and have lock nuts 12 by which they can be locked in adjusted positions.

The lever 5 has projections in the form of hooks 13, one at each side of the mask, these projections being conveniently placed close to the angles 7 and thus being spaced downwards from a line joining the forward extremity of the lever 5 to the hinges 6. The hinges 6 have a common axis disposed above the centre of pressure of the mask, the hooks 13 being spaced from the hinges 6 to such an extent that they lie approximately at the same level as the centre of pressure of the mask when swung downwardly into the position shown in FIGURES 1 and 3.

To provide an adjustment by which the wearer can have a choice of two degrees of pressure of the mask, the U-shaped member 9 is attached to the extremity of the lever 5 by means of a short linking lever 14. The lever 14 has two parallel holes in one of which the forward extremity of the lever 5 is pivotally mounted whilst the other accommodates the yoke of the member 9. When the mask is fitted to the face of the wearer as shown in FIGURES 1, 3 and 4, the lever 14 can be locked about the forward extremity of the link 5 either upward to the limiting position shown in FIGURES 1 and 3 or downwards to the opposite limit of its movement as shown in FIGURE 4. The two limits of movement may be determined by the engagement of the lever 14 with the front face of the backing member 4 or by any other suitable means.

In the construction shown in FIGURES 1 and 2 of the drawings, the tension elements of the linkage are releasably attached to a head band support by engaging each eye 11 in a spring catch 15 on an attachment plate 16 fixed to a housing of an ear-piece 18.

In addition to the mask, the equipment shown in FIGURES 1 and 2 comprises a pair of ear-phones and a bearing 20 for an arm 21 at the end of which is a microphone capsule 22. The arm may be attached to the housing of either ear-piece and is curved so that when it is pulled

forward the capsule is supported immediately in front of the face of the wearer and thus provides a microphone when the mask is not in position on the wearer's face. The microphone is swung up to the position shown in FIGURE 1 to permit the mask to be used. The earpieces are attached to a head-band **25**. The two attachment plates **16** are connected by an adjustable counter pressure band **30** (FIGURE 1) which passes round the back of the head of the wearer and takes the pull of the tension members of the linkage above referred to.

FIGURES 3 and 4 of the drawings show a mask and linkage which are exactly the same as those shown in FIGURES 1 and 2 but in which the support attached to the head of the wearer is a helmet instead of a head-band, the eyes **11** being attached to hooks provided for them on the flying helmet.

FIGURE 5 of the drawings is a diagrammatic representation of the linkage hereinbefore described wherein "POC" represents the lever **5**, "BC" represents the linking lever and "BOA" represents the flexible tension member, "B" being the end attached to the linking lever **14**, "A" being the end attached to the spring catches **15** and "O" being the point where the tension member passes over the projected hooks **13**.

Whether the mask is attached to a head-band as shown in FIGURES 1 and 2 or to a helmet as shown in FIGURES 3 and 4, it will rest on the chest of the user in the manner shown in FIGURE 2 when not in use. To bring the breathing mask into use the user places the mask in position over his nose and mouth and simultaneously tightens the linkage by which the mask is attached to the head support by rocking the lever **5** downwards to the limit of its downward swinging movement. During this action, the chains **8** are moved into engagement with the projecting hooks **13** so that the pull of the tension members acts on the mask at the hooks **13**. In other words, the line of action "OA" (FIGURE 5) of the force of the tension members is determined by the position of the projecting hooks **13** when the lever **5** reaches the downward limit of its swinging movement with the mask fitted to the user's face. It will be seen that, in this position, the pull of the tension links tends to rock the lever anti-clockwise as seen in FIGURE 5, thereby locking the lever in its downwardly swung position.

The linking lever **14** is normally swung up to the position shown in FIGURES 1 and 3 and the turn-buckles **10** are adjusted to hold the mask against the face with sufficient pressure for ordinary oxygen breathing with the linking lever in this upward position.

From the position shown in FIGURES 1 and 3, an increase in the pressure of the mask against the face of the wearer can be achieved simply by rotating the lever **14** in the direction of the arrow "R" in FIGURE 1 to the position shown in FIGURE 4. In reaching this position the two arms of the lever **5** pass between the arms of the U-shape member **9** and chains **8**, the effect being to apply greater tension to the member **9** and greater compression to the lever **7**, thus increasing the pressure applied to hold the mask against the face. This can be readily understood from FIGURE 5 of the drawings in which the full line "BC" represents the first position of the lever **14** and the dot and dash line "B'C" represents the second position of the lever **14**. The lever **14** thus provides a choice of two degrees of pressure of the face-piece against the face of the wearer. The second position may be suitable for flying at great heights where the face-piece must be held very firmly under strong pressure to the face of the wearer to provide for pressure breathing, where as the first position is suitable for use at lower altitudes where the face-piece may be held more lightly with consequent greater comfort to the wearer.

It will be observed that in all conditions of the apparatus with the face-piece fitted to the user's face, the projecting hooks **13** occupy the position determined by the downward limit of swinging movement of the lever **7**. The line of action of the force applied to the mask by the tension elements **8** is thus invariable. In particular, it is not disturbed by adjustment of the lever **14** to increase or diminish the pressure of the mask against the wearer's face, because the tension element merely slides through the projecting hooks **13** when the lever **14** is adjusted. The hooks **13** are arranged to be close to the face-piece and on a level close to that of the centre of pressure of the face-piece so as to minimise leakage due to uneven pressure round the edges of the mask and to reduce the chance of the mask being levered off the face by high or sudden acceleration.

I claim:

The combination, comprising a support for attachment to a person's head; a breathing mask; levers pivotally mounted at their inner ends on said mask at each side thereof for simultaneous limited upward and downward swinging movements on said mask about an axis disposed above the center of pressure of the mask, said levers having forwardly extending portions and having lateral projections disposed at points spaced downwardly from a line joining the forward extremities of the levers and their pivotal attachments to the mask; said levers having arms which are cranked downwardly from said pivots forming angles with the forwardly extending portions of the levers; said projections being disposed at the ends of the arms remote from the pivots and being spaced apart less than the width of the mask and being adapted to seat upon the mask to limit the downward swinging movements of the levers; said projections being so spaced from the pivots that the projections lie approximately at the same level as the center of pressure of the mask when the levers are swung downwardly; limp tension members connected with said support at each side thereof; adjustable tensioning means connecting the outer ends of the tension members to the forwardly extending portions of the levers and comprising a short linking lever having means thereon pivotally receiving the forward ends of the levers and the forward ends of said limp tensioning members, whereby when the short linking lever is swung upwardly the mask will be pressed against the wearer's face by a pressure different than when the linking lever is swung downwardly; and said tension members slidably engaging said projections respectively on downward movement of said levers for locking said levers in their downwardly swung positions with the projections seated upon the mask.

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