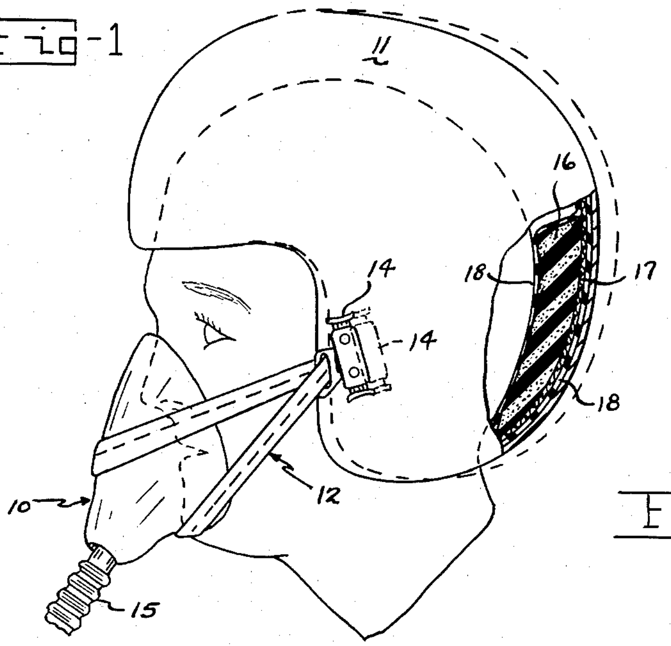
Feb. 7, 1961 H. W. SEELER 2,970,593

MASK-HARNESS TENSION COMPENSATING DEVICE

Filed May 6, 1957

Fig-1



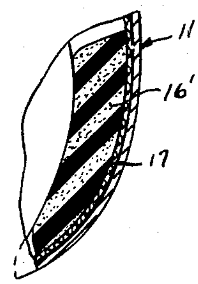


Fig 2

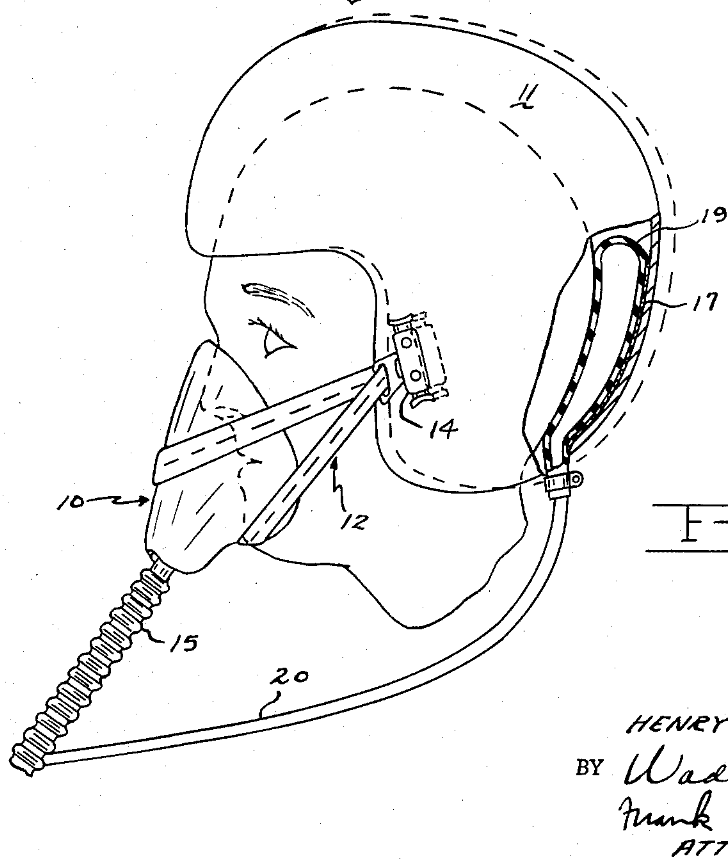


Fig-3

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MASK-HARNESS TENSION COMPENSATING DEVICE

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4 Claims. (Cl. 128—142)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a device for regulating the tension of the harness connecting a breathing mask to a headgear and, more particularly, to a device that automatically regulates the tension of the harness connecting the breathing mask to the headgear in accordance with the ambient pressure.

In connecting a high altitude oxygen breathing mask to a headgear by a harness, it is necessary to adjust the tension of the harness at ground level so that the mask is leak proof not only at demand breathing, but also at pressure breathing up to fourteen inches of water, the later condition existing at high altitudes. The harness tension, which is required to insure that there is no leakage about the mask at high altitude, is sufficiently large that it creates an uncomfortable mechanical pressure around the face of the wearer and especially in the nose area.

One method of alleviating this problem of an uncomfortable fit of the mask against the face of the wearer when large harness tensions are not required it to use a manual adjustment of the harness connection to the mask. This has the problem of requiring a manual actuation; the high speed of jet aircraft, for example, requires such constant attention of the pilot that even the slight diversion to manually adjust the mechanism may create an accident hazard. This manual adjustment also has only one variation in the tension of the mask harness whereby a greater tension of the harness is employed before it is needed to seal the mask against the face of the wearer.

The present invention satisfactorily solves these problems by requiring only a small harness tension at ground level to make the mask leak proof during demand breathing. While this small harness tension furnishes the seal during demand breathing, only a slight pressure exists on the wearer's face so that the mask is substantially comfortable. As the aircraft gains altitude, the present invention increases the harness tension in response to the decrease in ambient air pressure. This results in the mask tightening against the wearer's face as the altitude increases, but it does not increase the pressure of the mask against the wearer's face substantially beyond that required to insure a seal between the mask and the wearer's face. When very high altitudes are encountered, the harness tension is increased further so that a large pressure is created by the mask against the wearer's face to thereby seal during pressure breathing at large vacuums. However, as soon as the altitude decreases, the harness tension reduces accordingly.

An object of this invention is to provide a device for automatically adjusting the tension of the harness of a breathing mask according to the ambient altitude.

Another object of this invention is to provide a device that increases the force holding the breathing mask against the face of the wearer as the ambient pressure decreases.

Other objects of this invention will be readily perceived from the following description.

This invention relates to a breathing mask for use with a headgear or the like having harness means connecting the mask to the headgear. Means is secured to the headgear and is responsive to the ambient pressure to regulate the tension of the harness means.

The attached drawing illustrates preferred embodiments of the invention in which

Fig. 1 is an elevational view, partly in section, of the compensating device of the present invention employed with a breathing mask;

Fig. 2 is a fragmentary view, similar to Fig. 1, of another form of the present invention; and

Fig. 3 is an elevational view, partly in section, of another type of compensating device.

Referring to the drawing and particularly Fig, 1, there is shown an oxygen breathing mask **10** connected to a headgear **11** such as a hard shell helmet, for example, by harness straps **12**. The headgear **11** may be a soft helmet, a headset, or a net helmet, if desired. It is only necessary that the headgear be joined to the harness straps **12** to support the mask **10**. The harness straps **12** are joined to the headgear **11** by a connecting mechanism **14**. Oxygen is supplied to the breathing mask **10** in a well-known manner through a conduit **15**.

Disposed between the occipital area of the wearer and the interior of the helmet is a resilient or expansible member **16**. The resilient member **16** is preferably made of foam rubber of the open cell type with a fabric **17** adjacent one portion thereof. The fabric **17** is secured to the foam rubber by dipping the resilient member **16** in a rubber bath to form a rubber coating **18** around the entire surface of the resilient member. This seals the air within the open cells of the foam rubber but permits ready communication between the various cells to prevent any rupture thereof. Thus, the resilient member **16** is formed with air trapped in the interior thereof. By securing the portion of the resilient member **16** having the fabric **17** secured thereto to the inside of the headgear **11**, it is prevented from moving up or down, as viewed in Fig. 1; thus any expansion or contraction of the resilient member **16** must occur between the occipital area of the wearer and the headgear **11**.

Considering the operation of the present invention, the breathing mask **10** is connected to the headgear **11** at ground level with the tension of the harness straps **12** being sufficient to urge the mask into sealing relationship with the face of the wearer; however, the pressure of the mask on the face of the wearer is very slight. As the altitude of the aircraft increases, the ambient pressure decreases and the trapped air in the resilient member **16** expands. This causes the headgear **11** to move backwards toward the position shown by the dotted lines of Fig. 1. Since the movement of the headgear **11** in the backward direction moves the connecting mechanism **14**, the tension of the harness straps **12** increases. The size of the interior of the resilient member **16** is designed so that the tension of the harness straps **12** will always be sufficient, after the mask **10** is secured against the face of the wearer at ground level sufficiently to form a seal therebetween, to maintain a seal between the mask and the face of the wearer at any altitude. When the aircraft descends in altitude, the resilient member **16** contracts since the ambient pressure increases and the headgear **11** returns toward its solid line position of Fig. 1. As the headgear **11** moves forward, the tension of the harness straps **12** reduces but is still sufficient to maintain a seal between the mask **10** and the face of the wearer.

In Fig. 2, there is shown a resilient member **16'**, which is made of foam rubber of the closed cell type, instead of the member **16**. Otherwise, the structure is the same as Fig. 1. The closed cell type has air trapped in each of its cells and no rubber coating is necessary but a fabric **17** is secured to one side of the member **16'**. The resilient member **16'** is secured to the interior of the headgear **11** similar to the resilient member **16** by securing the portion of the member **16'** having the fabric **17** secured thereto to prevent the member **16'** from moving vertically. This causes the expansion and contraction of the member **16'** to occur between the occipital area of the wearer and the headgear **11**.

The movement of the headgear **11** of Fig. 2 is similar to that of Fig. 1. Thus, the tension of the harness straps **12** increases through rearward movement of the headgear **11** when the altitude increases and decreases through forward movement of the headgear **11** when the altitude decreases.

The modification of Fig. 3 is similar to Fig. 1 in that the breathing mask **10** is secured to the headgear **11** by the harness straps **12** through the connecting mechanism **14**. Oxygen is supplied to the breathing mask **10** through the conduit **15**.

The resilient member **16** of Fig. 1 is replaced in the embodiment of Fig. 3 by a hollow resilient member **19**, which is preferably formed of rubber. This member **19** is disposed between the occipital area of the wearer and the interior of the headgear; it is secured to the inside of the headgear to insure that its expansion and contraction occur in a horizontal direction rather than in a vertical direction. The portion of the member **19** secured to the headgear has a fabric **17** secured thereto to prevent damage to the material of the member.

The interior of the resilient member **19** is connected to the conduit **15** by a conduit **20** so that a portion of the oxygen supplied through the conduit **15** to the breathing mask **10** flows into the interior of the resilient member **19**. As the ambient pressure decreases due to the increase in altitude, the pressure of the supply oxygen increases to increase the pressure within the interior of the resilient member **19** to move the headgear **11** backwards toward its dotted line position of Fig. 1. This results in the connecting mechanism **14** moving rearwardly to increase the tension of the harness straps **12**. When the aircraft descends, the pressure of the supply oxygen flowing through the conduit **15** decreases; the combination of the increased ambient pressure and the decreased oxygen supply pressure within the interior of the resilient member **19** causes the resilient member **19** to contract and return the headgear **11** toward its solid line position. This, of course, reduces the tension of the harness straps **12** in the same manner as the contraction of the resilient member **16** of Fig. 1. The size of the resilient member **19** is selected so that the tension of the harness straps **12** is always sufficient to maintain a seal between the mask **10** and the face of the wearer at any altitude after a seal has been formed at ground level. The resilient member has an area approximately the same as the area of the oxygen mask **10** to insure that the compensation of the tension of the harness straps **12** is as desired.

It will be understood that the resilient member **16**, **16'** or **19** may be secured to the exterior of the headgear **11**, if desired. Since there would be no movement of the headgear **11**, it would be necessary to secure the resilient member to the harness straps whereby the movement of the resilient member would vary the tension of the harness straps to maintain a seal between the mask and the face of the wearer.

It will be understood also that the regulation of the expansion and contraction of the resilient member may be manual rather than automatic, if desired. For example, a manual controlled valve could be employed in the conduit **20** to regulate the oxygen flow therethrough to the interior of the resilient member **19** whereby the pressure within the member **19** could be varied manually.

An advantage of this invention is that it provides a more comfortable fit of the mask at low altitude flying. Another advantage of this invention is that the pilot is not required to manually adjust the tension of the mask harness as the altitude varies. A safety factor of this invention is that the automatic adjustment of the tension of the mask harness insures that there is no leakage around the mask.

For purpose of exemplification, particular embodiments of the invention have been shown and described according to the best present understanding thereof. However, it will be apparent that changes and modifications in the arrangement and construction of the parts thereof may be resorted to without departing from the true spirit and scope of the invention.

I claim:

1. In combination, a headgear, a breathing mask, harness means connecting the mask to the lower front portion of said headgear, and resilient means affixed to the inside, rearwardmost portion of the headgear and adapted to be disposed between the interior of the headgear and the occipital area of the wearer to increase of decrease automatically the tension of the harness means as the pressure correspondingly increases or decreases, said resilient means affixed to said headgear comprising an open cell foam rubber member and an impervious rubber coating enclosing said foam rubber member so that air is trapped within said foam rubber.

2. In combination, a headgear, a breathing mask, harness means connecting the mask to the headgear, a resilient member positioned in fixed relation to the inside of the headgear and adapted to be disposed between the interior of the headgear and the occipital area of the wearer, inlet conduit means for supplying oxygen to said breathing mask, and means to divert to the interior of the resilient member a portion of the oxygen supplied to said breathing mask by said inlet conduit means whereby the resilient member expands as the oxygen pressure increases when the ambient pressure decreases to increase the tension of the harness means and vice versa.

3. In combination, a headgear, a breathing mask, harness means connecting the mask to the bottom-front portion of said headgear, a hollow resilient member secured interiorly to the lower portion of the headgear so that the occipital area of the wearer is contacted by said resilient member, first conduit means attached to said breathing mask and adaptable for delivering a main supply of oxygen thereto, and second conduit means in communication between said first conduit means and the interior of said hollow resilient member to divert to the interior of the resilient member a portion of the oxygen delivered to the breathing mask whereby the resilient member expands as the oxygen pressure increases when the ambient pressure decreases to increase the tension of the harness means and vice versa.

4. A breathing mask for use with a headgear or the like, harness means connecting the mask to the lower front portion of said headgear, and a resilient member affixed to the interior rear portion of said headgear and adapted to be disposed between the interior of the headgear and the occipital area of the wearer, a conduit attached to and in communication with said breathing mask and adapted to supply oxygen thereto, passage communicating means to divert to the interior of the resilient member a portion of the oxygen supplied to the breathing mask by way of said conduit whereby the resilient member expands when the oxygen pressure increases as the ambient pressure decreases to increase the tension of the harness means and vice versa.

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UNITED STATES PATENT OFFICE

CERTIFICATION OF CORRECTION

Patent No. 2,970,593 February 7, 1961

Henry W. Seeler

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 34, for "it" read -- is --; column 4, lines 20 and 21, for "to increase of decrease automatically" read -- to automatically increase or decrease --.

Signed and sealed this 1st day of August 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents