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J. E. GABB ET AL
RESPIRATORY MASKS

2,814,293

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4 Sheets-Sheet 1

Fig. 1.

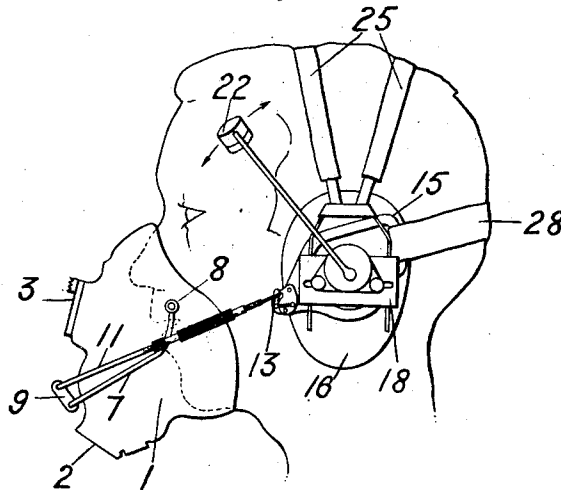
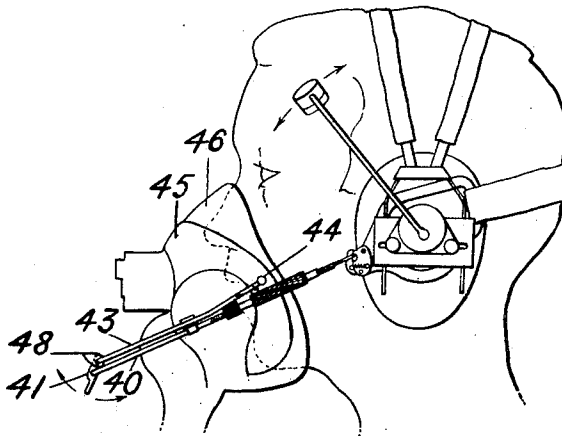


Fig. 3.



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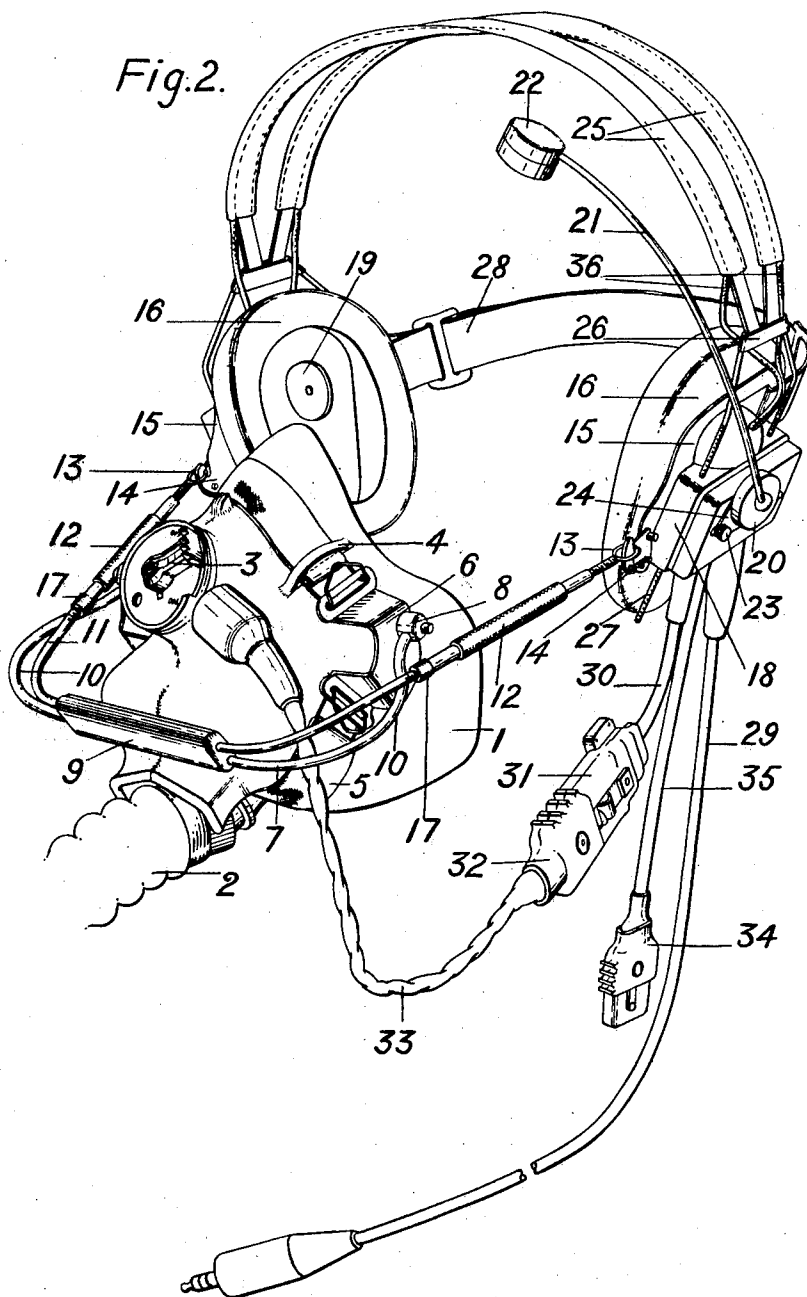
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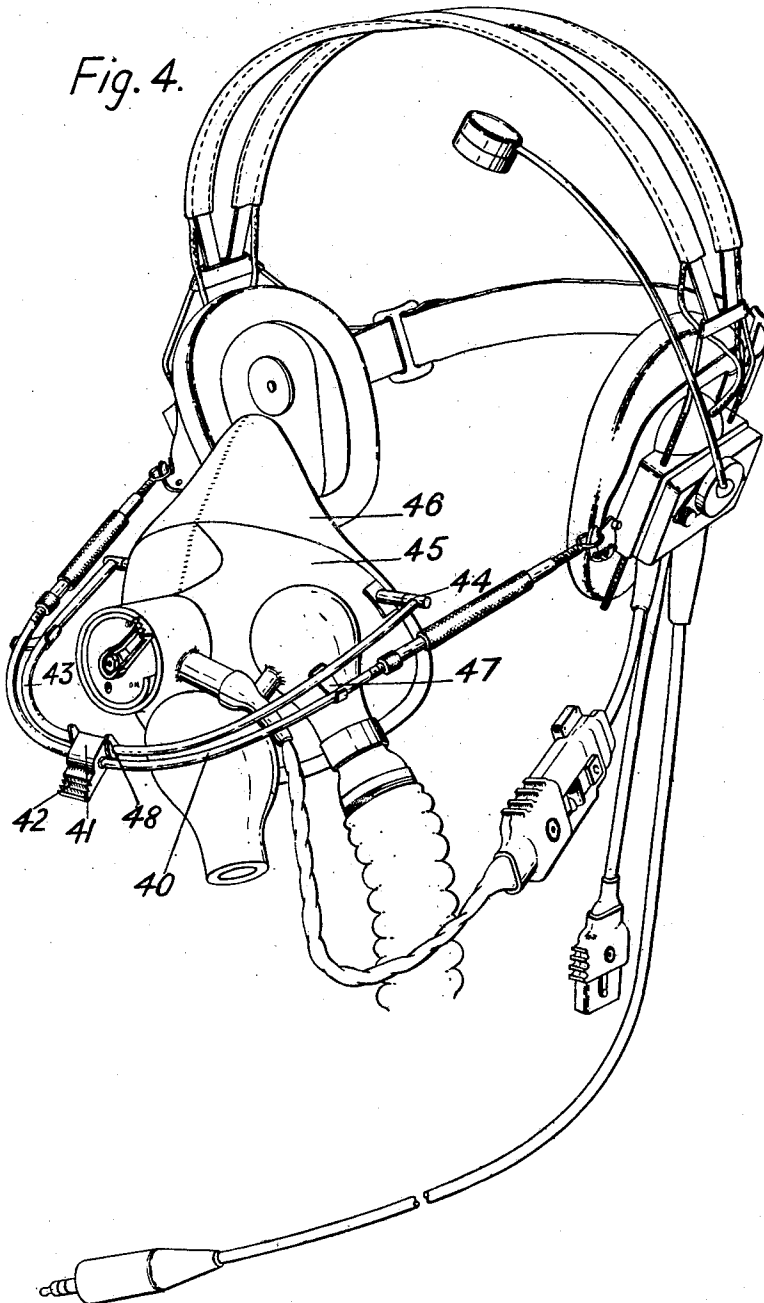
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Fig. 4.



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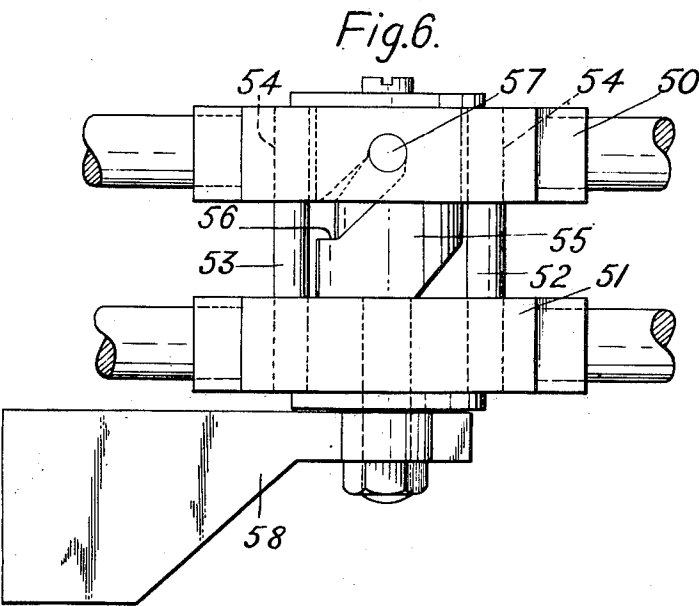
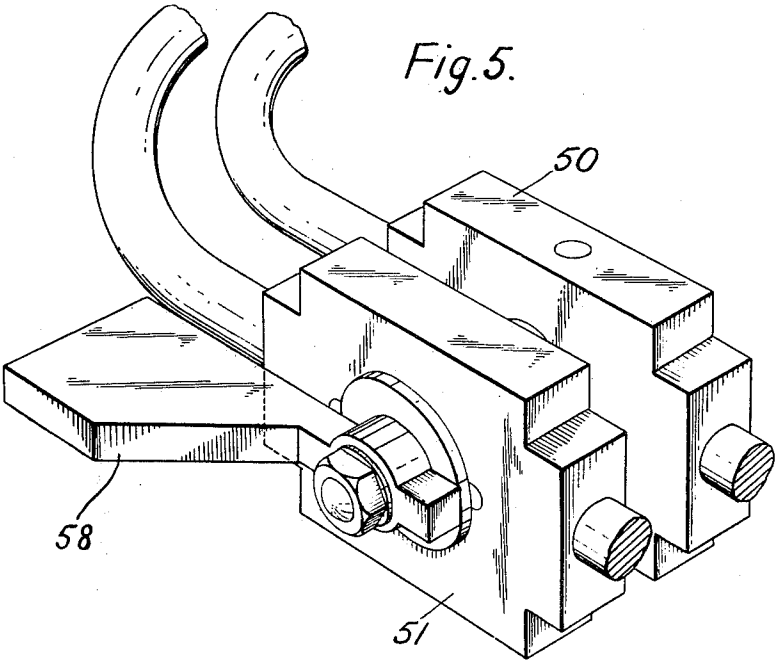
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RESPIRATORY MASKS

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Claims priority, application Great Britain
February 16, 1954

14 Claims. (Cl. 128—146)

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 round the edges of the mask.

Particularly in oxygen masks for aircrews, provision has to be made for a microphone, and the harness also carries head-phone ear-pieces. The wearer should be able to fit and remove the mask easily and quickly, and he should still be able to speak into either a mask microphone or a secondary microphone even when the mask is not in position on his face. In usual arrangements the mask dangles from one side of the helmet or harness and has to be pulled into position by the hand if the microphone in the mask is to be used. This is inconvenient, since the pilot or other occupant of an aircraft may, at any particular moment, have both hands occupied. Also, existing forms of flexible flying helmet form an unsatisfactory structure to which to attach a pressure breathing mask.

The present invention enables the mask to be held perfectly firmly by a head harness if desired instead of a flying helmet. This greatly increases the comfort of the wearer, particularly when flying in hot climates, by reducing the tendency of the head to sweat, and disturbance to the hair, and also reduces the risk of scalp infection which occurs when a helmet is worn for a long time, particularly in bad conditions. The mask may be clamped into position on the face quickly, and when the mask is not in use, it hangs on the chest immediately beneath the wearer's chin, so that there is no unbalanced weight on the head and the mask is ready to be fitted at any moment.

For flying at great heights above, say 35,000 feet, it is necessary for a more complicated form of oxygen mask known as a pressure breathing mask to be provided and this must be held very firmly to the face of the wearer. However, below these heights, it is not necessary for such a strong pressure to be exerted and we have, therefore, evolved an arrangement by which the mask can be held to the wearer's face with alternative pressures which can easily be selected, so that below extreme heights, only the lighter pressure can be used with consequently greater comfort to the wearer.

According to the invention, the face-piece of a respiratory mask is connected to a head harness by a pair of links on each side. One link is hinged to the face-piece and is pivoted at its other end to the other link which is hinged to the head harness. The arrangement is such that when the mask is worn the two links at each side project forwards from these hinges, and the axes joining the pivots in each of the two links are nearly parallel, a stop being provided to arrest the breaking of the toggle so formed on one side of the parallel, dead centre, position of the axes. The links may be hinged together by a short connecting member in which the links are journalled. When the wearer wishes to remove the mask, he pushes this member upwards past the dead-centre posi-

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tion breaking the toggle so that the mask drops from his faces and rests on his chest hanging from both ear-pieces by the two links. In this way, in any emergency, the mask may be placed in position and secured to the wearer's face in two seconds.

To provide for two different pressures the relative positions of the pivotal axes of the links in the short connecting member may be varied either by adjusting the angle of the member or by providing a movable journal for one of the links in the member.

Two examples of masks according to the invention, are shown in the accompanying drawings in which:

Figure 1 is a side view of a mask providing one pressure for medium altitude flying in position on the wearer;

Figure 2 is a perspective view of the mask shown in Figure 1;

Figure 3 is a similar view to Figure 1 of a high altitude mask having two alternative pressures;

Figure 4 is a perspective view of the mask shown in Figure 3;

Figure 5 is a perspective view, and

Figure 6 is a plan view of an alternative arrangement for changing over the pressures in the mask of Figures 3 and 4.

In Figures 1 and 2, the mask comprises a rubber face-piece 1 moulded to the face of the wearer and provided with an attachment 2 for an oxygen pipe, and a microphone controlled by a switch 3. The breathing valves and internal arrangements of the mask form no part of the invention and are not illustrated. The rubber face-piece 1 has a series of integrally moulded lugs 4 (in Figure 2) through which pass straps 5 by which attachment pieces 6 are secured to the face-piece. Two compression links are formed by the arms of a U-shaped rod 7 which is pivoted at each end to one of the attachment pieces 6 at 8, and the center of which passes through one of two parallel holes in a metal sleeve 9. The distance between the arms of the U-shaped rod 7 decreases from the points 10 to the attachment points 8 so that at the points 10, the U-shaped rod 7 is wider than a U-shaped rod which passes through the second hole in the sleeve 9 and forms the tension link 11 on each side. Each end of this rod is threaded into an adjustable turn-buckle 12 at the other end of which is an eye 13 engageable in a spring catch 14 on an attachment plate 15 which is rotatable on the moulded housing 18 of the ear-piece 16. After the turn-buckles 12 have been adjusted, they can be locked by means of lock nuts 17. The ear-pad ring 16 is anatomically designed to give the greatest possible comfort with the maximum exclusion of external noise.

The tension links 11 are longer than the compression links 7, and the parts 7, 9 and 11 form on each side of the mask a toggle linkage capable of holding the face piece 1 firmly against the face of the wearer. In the working position, the two links 7 and 11 at each side project forwards from the hinged connections 8 and 13 respectively and the axes joining the pivots of the links are nearly parallel as shown in Figures 1 and 3, the relatively wide parts 10 of the U-shaped rod that forms the links 7 acting as a stop to prevent further downward movement of the links 11 relatively to the links 7 after they have passed through the parallel or dead-centre position. The linkage is finally tightened by rocking the sleeve 9 anti-clockwise from the position shown in Figures 1 and 3 so as to increase the compression of the link 7. When the wearer wishes to remove the mask he first pushes the front edge of the member 9 upwards past the dead-centre position and into the position shown in Figures 1 and 3 thus loosening the main toggle. The front ends of the links 7 and 11 can then easily be lifted so as to break the main toggle and allow the mask to

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drop from his face and rest on his chest hanging from both ear-pieces by the two links 11.

The moulded housing 18 of each ear-piece has an ear-phone 19. A bearing 20 for an arm 21 at the end of which is a microphone capsule 22 may be attached to the housing of either ear-piece. The arm 21 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 bearing 20 can be adjusted on the housing 18 by slackening a lock nut 23 and sliding to and fro the plate 24 on which the bearing 20 is mounted. The ear-pieces are supported on a pair of padded flexible steel headbands 25 connected at each end by a cross-piece 26 from which two knurled wires 27 pass through vertical bores in the housing 18. The housing and ear-pieces can thus be adjusted up and down in relation to the headbands. The two attachment plates 15 are connected by an adjustable counter-pressure band 28 which, as shown in Figure 1, passes round the back of the head of the wearer and takes the pull of the linkage connecting the harness to the face-piece. The microphone and headphone leads 29 run to the housing 18 in the left hand ear-piece and from there a lead 30 runs to a plug 31 which can be connected alternately to a plug 32 on a lead 33 running to the microphone in the face-piece 1 or to a plug 34 on a lead 35 running to the microphone capsule 22. Flexible leads 36 run through the padded covering of the headbands 25 to the right hand ear-piece.

In Figures 3 and 4, the tension link 40 is similar to the tension link 11 in Figures 1 and 2, but is journalled in a short connecting member 41 formed with a finger piece 42. The short compression links 43 are pivoted directly at 44 to a fretted plastic support 45 for the moulded rubber face-piece 46. The short compression links do not extend outwards beneath the tension links 40 as in the previous example, but are provided with small hooks 47 which prevent the tension links 40 dropping appreciably below the compression links 43. The short connecting member 41 is movable through a dead centre position in which its hinged connection to the compression links is disposed directly behind its hinged connection to the tension links to either of two limiting positions which give different degrees of pressure between the face piece and the wearer's face. In the position shown in Figures 3 and 4, the maximum pressure is exerted. When less pressure is required, the finger piece 42 is raised until the tension links 40 bear upon stop lugs 48 on the compression links 43, in which position the centre of the tension link is more nearly above the centre of the compression link so that less pressure is exerted.

In Figures 5 and 6, the sleeve and finger pieces 41, 42 are replaced by two members 50, 51 which can be moved towards and away from each other to alter the pressure. The member 51 carries a pair of pillars 52, 53 which slide in bores 54 in the member 50 and thus maintain the two members in alignment. A shaft 55 is journalled in both these members and is parallel to the pillars 52, 53. This shaft has a helical groove 56 in which a pin 57 in the member 50 engages so that, as the shaft is rotated by means of a hand lever 58, this pin is moved along the groove, thus moving the member 50 towards and away from the member 51. In the position shown, the maximum pressure is exerted on the face-piece.

We claim:

1. A respiratory mask comprising a face-piece, a head-harness and a toggle linkage connecting said face-piece to said harness, said toggle linkage comprising at each side of the mask a pair of links, one hinged to the face-piece and pivoted at its other end to the other link which has means for hinging it to the head harness, such that, when the mask is worn, the two links at each side project forwards from these hinges and the axes joining the pivots in each of the two links are nearly parallel, a stop

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being provided to arrest the breaking of the toggle on one side of the parallel, dead centre, position of the axes.

2. A respiratory mask according to claim 1, in which, on each side of the mask, the stop is adapted to limit the downward movement of the links past the said parallel position of the axes.

3. A respiratory mask according to claim 2, in which the upper surface of the link which is pivoted to the face-piece is engaged by the lower surface of the link pivoted to the harness to form a stop.

4. A respiratory mask comprising a support capable of attachment to the head of the wearer, a face piece, and a toggle linkage at each side of the face piece composed of a first link having one end hinged to said face piece, a short connecting member attached to the other end of said first link, a second link attached at one end to said short connecting member and provided at its other end with means for pivotally attaching it to said support, said second link being of greater length than said first link and said links being movable to an operative position in which both links extend forwards from their points of attachment to said face piece and support respectively, and said short connecting member being adjustable to alter the relative positions of the face-piece and support without breaking the toggle, thus exerting alternative pressures on the wearer's face.

5. A linkage according to claim 1 in which the lengths of the links pivoted to the head harness are adjustable.

6. A respiratory mask according to claim 1 comprising a face-piece shaped at its edges to engage and seal against the face of a wearer and a head harness comprising ear-pieces connected by head bands encircling the crown and back of the head of the wearer.

7. A respiratory mask according to claim 4 in which the short member has two parallel holes in one of which the ends of the links hinged to the face-piece on each side of the mask are journalled, and in the other of which the ends of the links hinged to the head harness on each side of the mask are journalled.

8. A respiratory mask according to claim 4, in which the corresponding links on each side of the mask are formed as continuous members journalled at their centres in the holes in the short member.

9. A respiratory mask according to claim 1 in which the links are pivoted to the head harness by a quickly releasable connection.

10. A respiratory mask comprising a support capable of attachment to the head of the wearer, a face-piece, and a toggle linkage at each side of said face piece composed of a first link having one end hinged to said face piece and a second link coupled at one end to the other end of said first link and provided at its other end with means for pivotally attaching it to said support, said second link being of greater length than said first link and said links being movable to an operative position in which both links extend forwards from their points of attachment to said face piece and support respectively, stop means being provided for preventing downward movement of said second link relative to said first link from said operative position.

11. A respiratory mask comprising a support capable of attachment to the head of the wearer, a face piece and a toggle linkage at each side of the face piece composed of a compression link hinged to the face piece, a short connecting member hinged to said compression link, and a tension link, hinged at one end to said short connecting member and provided at its other end with means for pivotally attaching it to said support, the tension links being so much longer than the compression links as to be capable of holding the face piece firmly against the face of the wearer when both links extend forwards from their points of attachment to the face-piece and support respectively, and said short connecting member, being movable through a dead centre position in which its hinged connection to the compression links is disposed directly

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behind its hinged connection to the tension links to either of two limiting positions which give different degrees of pressure between the face piece and the wearer's face.

12. A respiratory mask comprising a support capable of attachment to the head of the wearer, a face piece and a toggle linkage at each side of the face piece composed of a compression link hinged to the face piece, a short connecting member hinged to said compression link, and a tension link hinged at one end to said short connecting member and provided at its other end with means for pivotally attaching it to said support, the tension links being so much longer than the compression links as to be capable of holding the face piece firmly against the face of the wearer when both links extend forwards from their points of attachment to the face-piece and support respectively, and said short connecting member having means for adjusting the distance between its hinged connections to the compression and tension links respectively.

13. A respiratory mask comprising a support capable of attachment to the head of the wearer, a face piece and a toggle linkage at each side of the face piece composed of a compression link hinged to the face piece, a short connecting member hinged to said compression link, and a tension link hinged at one end to said short connecting member and provided at its other end with means for pivotally attaching it to said support, the tension links being so much longer than the compression

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links as to be capable of holding the face piece firmly against the face of the wearer when both links extend forwards from their points of attachment to the face-piece and support respectively, and said short connecting member having helical cam means for adjusting the distance between its hinged connections to the compression and tension links respectively.

14. A respiratory mask according to claim 1, wherein the face piece is shaped at its edges to engage and seal against the face of the wearer and the head harness includes ear-pieces connected to head bands for encircling the crown and back of the head of the wearer, and in which each of the links hinged to the head harness is detachably connected to an attachment plate which is rotatable in a vertical plane on the earpiece such that the resultant pressure of the face-piece on the face and the forces in the links tend to become aligned with the counter-pressure band.

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