

[54] HARNESS FOR RAPIDLY PLACING IN POSITION A DEVICE SUCH AS A RESPIRATOR MASK

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[51] Int. Cl. A62b 18/08
[58] Field of Search .. 128/146.7, 146.3, 146, 142.4, 128/141; 351/118; 2/9, 14 B, 14 C, 14 R, 14 V

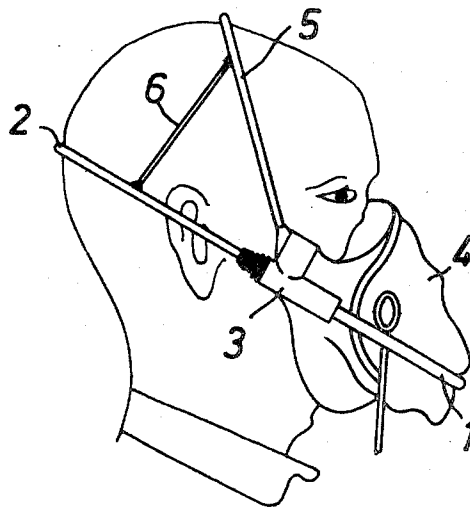
[57] ABSTRACT

A harness for rapidly placing in position a device, such as a respiratory mask, comprising at least one guide case fixed to said device, at least one semi-rigid strap slidably mounted in said case, elastic means for causing upon their release the sliding of said semi-rigid strap and locking means for locking said elastic means in a position of tension.

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14 Claims, 9 Drawing Figures



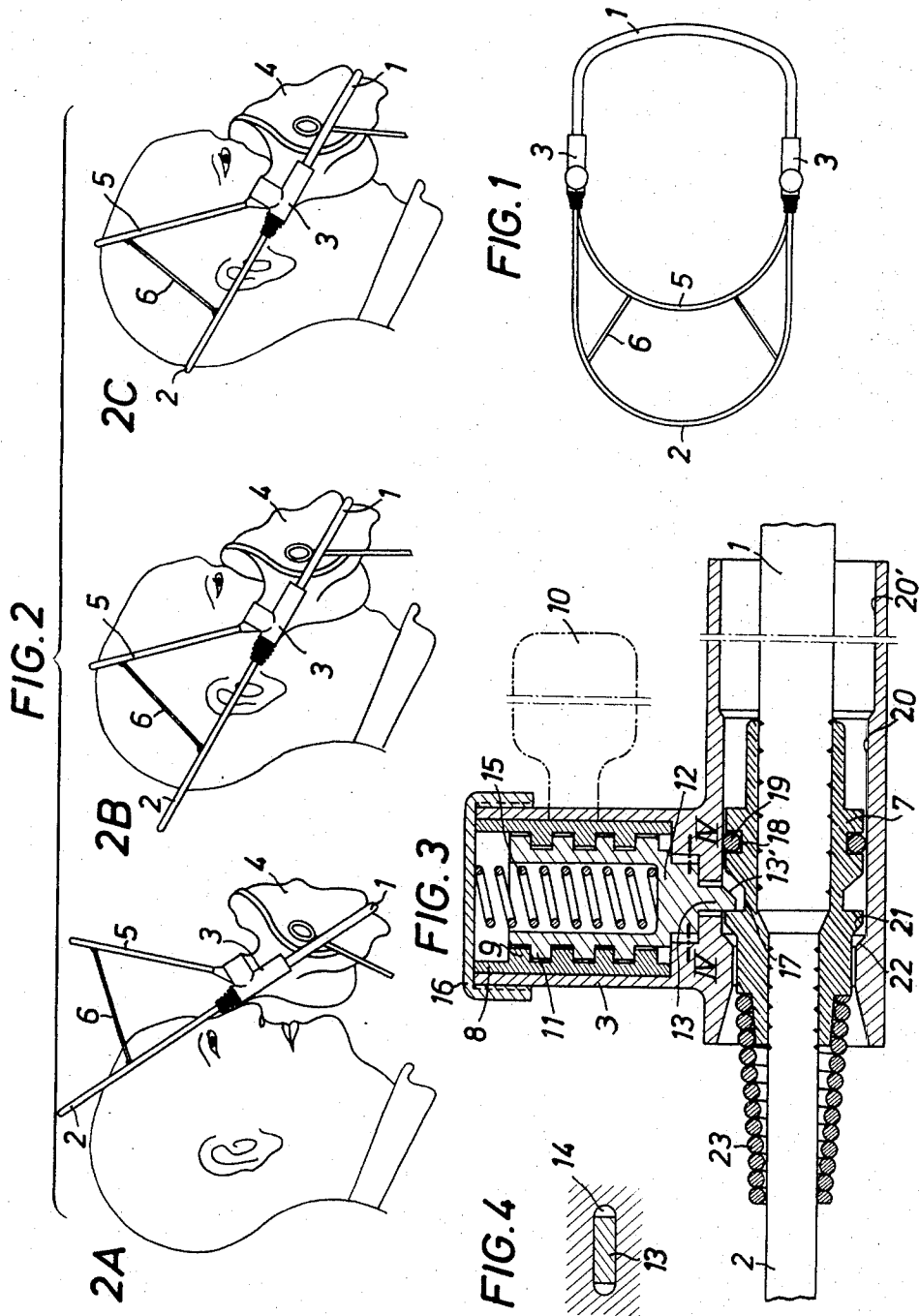


FIG. 5

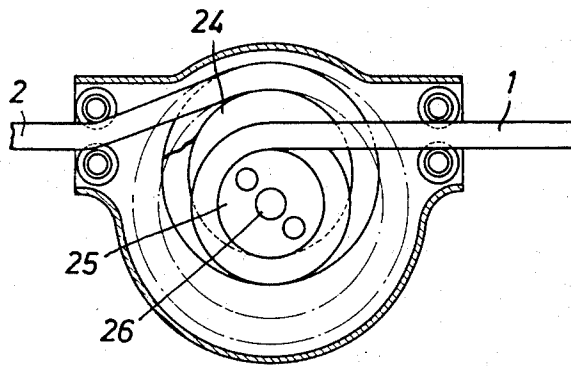
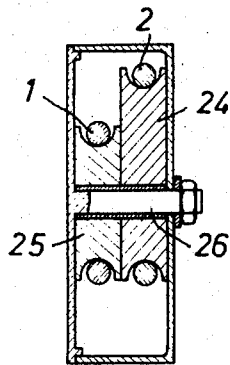


FIG. 6



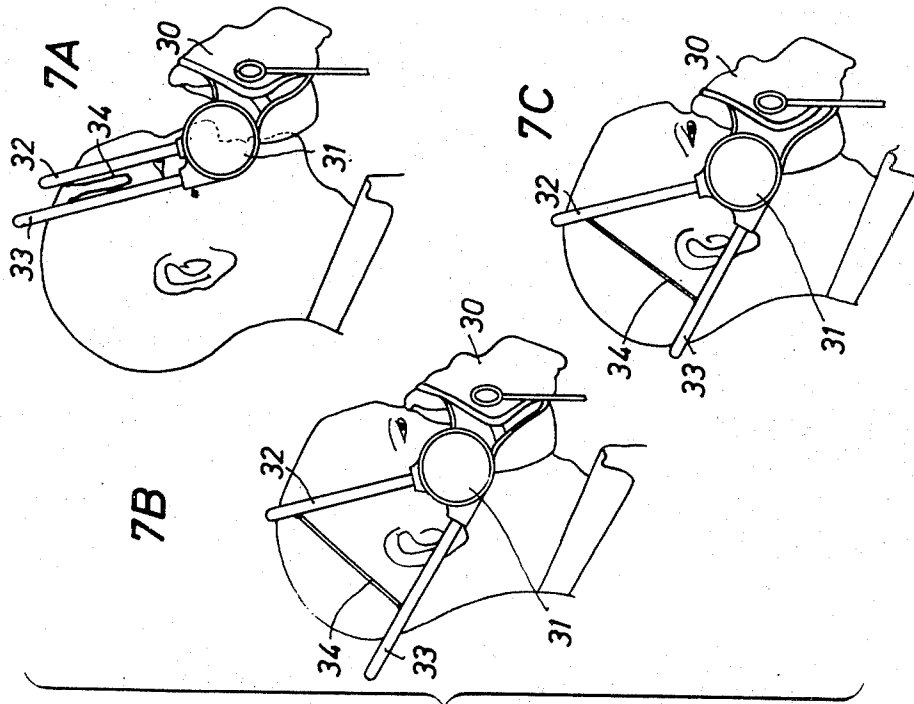


FIG. 7

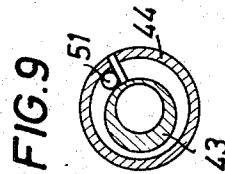


FIG. 9

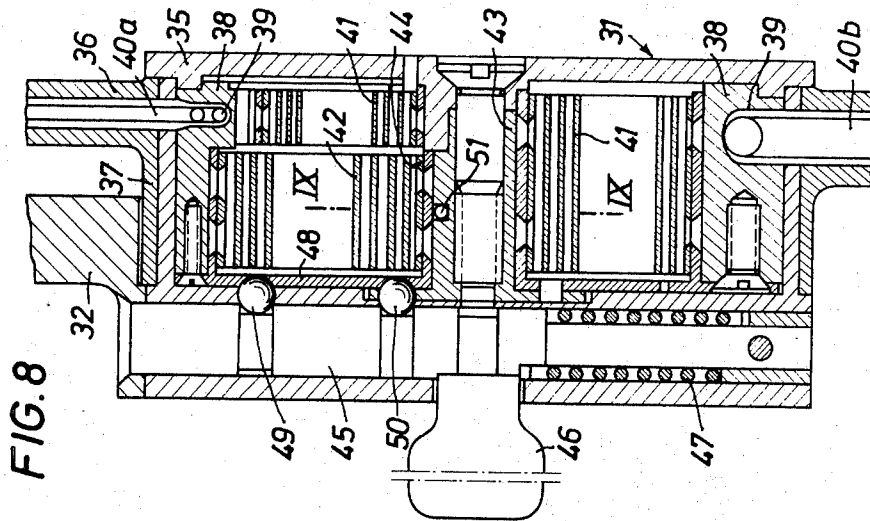


FIG. 8

HARNES FOR RAPIDLY PLACING IN POSITION A DEVICE SUCH AS A RESPIRATOR MASK

The invention relates to a harness for rapidly placing in position devices such as respiratory or breathing masks, protective glasses, earphones, microphones, mouthpieces, etc.

Harnesses of this type are known which comprise a fixing strap having a certain elasticity and provided with means for rendering it relatively rigid when placing the harness in position, the release of these means allowing the shortening of the strap which becomes tightened on the head of the user. The means in question may be constituted for example by tubes receiving a gas which inflates them and puts the strap under tension. This known device has the drawback among others of requiring a source of energy outside the user.

Further, in many cases, for example when a respiratory mask must be placed in position in an aircraft where the pressurization no longer produces its effect, the force of application must, beyond a certain altitude, be very great at the end of the movement of application to ensure the airtightness of the mask on the face.

In order to differentiate the force of placing in position and the force of application it has been proposed to make the harness in two holding branches pivoted to the mask, each of which is constituted by two elements pivoted together, the pivoting of arms on the mask producing a positioning in which the mask is lightly tightened whereas the pivoting of the pivoted elements remote from the mask produces the airtight application of the mask on the face of the user. However, this device may be delicate to operate and does not easily adapt itself to the configurations of different users.

An object of the invention is to provide a harness which does not have the aforementioned drawbacks and permits in particular the positioning, the adjustment, the removal and a further positioning with one hand. The sequences of operation required for the fixing are achieved automatically by an actuating control. Advantageously, this control is actuated by a feeler or follower.

The invention provides a harness for rapidly placing in position a device, such as a respiratory mask, comprising at least one guide case fixed to said device, at least one semi-rigid strap slidably mounted in the case, resiliently yieldable means arranged to produce, when released, the sliding of the semi-rigid strap, and locking means for locking said resiliently yieldable means in a position of tension.

The invention will be better understood with reference to the ensuing description of various embodiments of a harness according to the invention which are given by way of non-limitative examples with references to the accompanying drawings in which:

FIG. 1 is a diagrammatic plan view of one embodiment of the harness according to the invention.

FIG. 2 illustrates the stages of the positioning of the harness shown in FIG. 1.

FIG. 3 is a longitudinal sectional view of mechanical means actuating the harness shown in FIG. 1.

FIG. 4 is a sectional view taken on line 4—4 of FIG. 3.

FIG. 5 is a longitudinal sectional view of another embodiment of mechanical actuating means of a harness according to the invention.

FIG. 6 is an axial cross-sectional view of the mechanism shown in FIG. 5.

FIG. 7 is a view similar to FIG. 2 of another embodiment of the harness according to the invention.

FIG. 8 is a cross-sectional view of the actuating mechanism of the harness shown in FIG. 7, and

FIG. 9 is a sectional view taken on line IX—IX of FIG. 8.

With reference first to FIGS. 1—4 which illustrate a first embodiment of the harness according to the invention, the harness comprises an elastic strap 1 connected to both ends of a semi-rigid rear strap 2. Semi-rigid strap is intended to mean a strap which retains a well-defined shape while its length remains practically constant but which is foldable so as to facilitate storage. The connections between the elastic strap 1 and the rear strap 2 are enclosed in two cases 3 carried by the mask 4. A front strap 5 is integral with the two cases 3 and struts 6 maintain the rear strap 2 at a constant distance from the strap 5. As can be seen in FIG. 2, the elastic strap 1 bears against the mask 4 and can be advantageously guided by loops integral with the mask or by a sleeve connected to the mask (not shown).

The harness operates in the following manner (FIG. 2).

The mask, equipped with the harness and with the elastic strap 1 extended, is held in one hand in the inclined position shown at 2A. By tilting the mask, the rear strap 2 is placed behind the head of the user, the strap 5 bearing against the top of the head (position 2B). The elastic strap 1, which was maintained extended, is then released and, by shortening, it pulls on the two ends of the rear strap 2, a part of which ends enters the cases 3. The rear strap 2 is then held taut on the head of the user (position 2C) and the mask 4 is applied against the face of the user.

According to the invention, the elastic strap 1 is released, for the passage from the position 2B to the position 2C, in two stages, namely a first stage with a force which is intentionally weak corresponding to the positioning of the mask and a second stage with a large force corresponding to the airtight forceful application of the mask against the face. The release of the strap 1 is achieved by the mechanism shown in FIGS. 3 and 4.

Inside the case 3, the rear strap 2 and the elastic strap 1 are interconnected by a member 7. The case 3 contains in its upper part a nut 8 having a screw thread 9. The nut 8 can be rotated by means of a lever 10 shifted manually by the user or by means of a similar feeler which is urged back when it bears against the face of the user, so as to achieve an automatic positioning and tightening. The nut 8 is in abutment in the cavity provided therefor and consequently cannot slide in the longitudinal direction. The thread of the screw 9 of the nut 8 cooperates with a corresponding thread 11 of a screw 12 which is vertically movable (as viewed in FIG. 3) when the nut 8 is rotated, the end 13 of the screw 12 being engaged in a cavity 14 in the case 3 (see FIG. 4) so that the screw 12 is prevented from rotating. A coil spring 15 bears against the screw 12 at one end of the spring, the other end of the spring 15 being in abutment with a cover 16 which closes the case 3 and permits the assembly of the whole of the mechanism. The screwthread of the nut 8 and of the screw 12 has a large pitch (a multiple thread screwthread) so that the mechanism is reversible, that is to say, if the assem-

bly is released and the lever 10 is not held in position, the screw is rotated in the opposite direction by the action of the spring 15.

The member 7 interconnecting the straps 1 and 2 has a recess 17 against which the end 13 of the screw 12 abuts (position shown in FIG. 3) when the screw 3 is in its lower position. The member 7 also has an annular groove 18 containing a sealing ring 19 which is in rubbing contact with a guide face 20 in the case 3. The guide face 20 has an enlarged portion 20'. The member 7 also has an inclined abutment 21 which cooperates with an abutment 13' having the same profile on the end 13. The rear strap 2 is maintained on the correct axis by a spring 23 which permits correctly positioning the strap 2 when the mask is unfolded outside its container.

When the rotation of the lever 10 (or of the feeler) rotates the nut 8 and causes the screw 12 to rise, the end 13 of the latter releases the member 7 which is driven to the right as viewed in FIG. 3 by the shortening of the elastic strap 1 which was maintained under tension. During the first part of the travel of the member 7, the sealing ring 19 rubs against the guide face 20 and this moderates the action of the elastic strap 1. As soon as the ring 19 reaches the enlarged portion 20', it no longer exerts its breaking action and the elastic strap 1 expends all of its remaining energy in putting the rear strap 2 under tension and this brings about the second stage of the airtight application of the mask mentioned hereinbefore.

To remove the mask, the user pulls on the mask with one hand so as to put the elastic strap 1 once more under tension, the inclined slope of the abutment 21 slides along the slope 13' and raises the screw 12 which had been lowered under the action of the spring 15; as soon as it is located in front of the recess 17, the screw 12 redescends under the action of the spring 15. The harness is thus rearmored in the position shown in FIG. 3 after the abutment 22 has stopped the movement of the member 7.

The elastic strap 1 can be replaced by two straps each of which is fixed at one end to the strap 2 by a member 7, the other end being fixed to a suitable point of the mask or case 3. This arrangement permits an improved distribution of the pressure of application of the mask and increases the total length of the elastic strap.

With reference to FIGS. 5 and 6, instead of being directly fixed to the end of the elastic strap 1 or elastic straps, the rear strap 2 may be wound on a pulley 24 whereas the elastic strap 1 is wound on a pulley 25. The pulleys 24 and 25 are integral with each other and in eccentric relation and rotate about the axis of a spindle 26 which is the spindle of the pulley 25. It is understood that a mechanism (not shown) locks the pulleys in the position corresponding to the tension of the elastic strap 1, this mechanism being for example released manually or automatically. The release of the elastic strap 1 and its shortening causes the pulley 25 and consequently the pulley 24 to rotate in the clockwise direction (FIG. 5), the rotation of the eccentric pulley 24 about the spindle 26 causing the strap 2 to be wound thereon with a variable force owing to the difference in the leverages. If the position of locking is judiciously chosen, it is possible to achieve first a winding at a low force of application followed by a winding at a strong force of application in the desired manner.

The elastic straps may be advantageously of elastic textile and/or contain rubber and/or springs.

With reference now to FIGS. 7-9, these figures show other embodiments of the harness according to the invention for the application of a respiratory mask.

The mask 30 carries on each side in a symmetric manner two mechanical cases 31 supporting a fixed front strap 32 and a rear strap 33 which is movable with respect to the front strap 32 and whose ends are capable of being wound into the cases under the action of resiliently yieldable devices contained in the latter. The straps 32 and 33 are semi-rigid.

The mask is placed in position by applying the mask 30 to the face and the front strap 32 to the top of the head without tilting (position 7A). The depression of a feeler lever or a manual control causes the rotation of the rear strap 33 whose movement is limited by two cables 34 (position 7B). Thereafter, the ends of the rear strap 33 are pulled into the cases 31 so as to apply the mask against the face of the user (position 7C). Means may be provided for effecting the approach and then the correct application of the mask in two separate movements.

Advantageously, the mask may be foldable so as to reduce its overall size and the bearing of the elastic strap 1 on the mask automatically produces its unfolding when the folded mask is withdrawn from its container.

In FIG. 8, the upper half-sectional view shows one embodiment of the mechanism contained in the cases 31 and the lower half-sectional view shows another embodiment.

The front strap 32 is rigidly connected to the frame 35 of the case 31. The rear strap 33 (not shown) is integral through the agency of its guide member 36 with an outer member 37 which allows the rotation of the strap 33 about the frame 35. The pulley 38 rotates inside the frame 35 and its groove 39 receives either a flexible cable 40a (upper part) or a cable 40b of the type known by the trade name BOWDEN (lower part), the cables being attached to the pulley.

In the embodiment shown in the upper part of FIG. 8, the interior of the pulley 38 receives two spiral spring strips 41 and 42, each of which has one end integral with the large diameter of the pulley. The spring 41 has its other end connected to the fixed spindle 43 of the frame 35 whereas the spring 42 has its other end connected to a member 44. A shaft 45 is disposed in the frame 35 and can be rotated by the feeler lever 46 or by a manual control. The shaft 45 is biased to its initial position by a spring 47.

The cheek 48 of the pulley 38 has a cavity for a ball 49 which holds the pulley stationary in the frame 35 so long as the shaft 45 does not place in front of the ball 49 a corresponding cavity (not shown) which allows the ball 49 to retract, the cheek 48 also has a cavity for a ball 50 which connects the pulley to the member 44 which has a corresponding cavity, so long as the ball 50 does not have disposed in front thereof a cavity (not shown) which allows the ball to retract, the last-mentioned cavity being formed for example in the frame 35 or in the shaft 45.

In the embodiment shown in the lower part of FIG. 8, the rear strap 33 can be constituted by a cable 40b of the type known by the trade name BOWDEN and is capable of being shortened by winding it around the pulley 38 or lengthened by unwinding it from the pulley.

Irrespective of the design of the rear strap 33 and of the winding mechanisms, the harness operates in an identical manner, as follows.

Rotation of the lever 46 causes the shaft 45 to rotate and place a cavity in front of the ball 49. The ball 49 is urged into this cavity by the effect of the profile of the cavity in the cheek 48. This cheek has a tendency to rotate under the action of the spring 41. The cheek 48 and consequently the pulley 38 are released and the spring 41 can exert its action and rotate the pulley 38. The latter drives the rear strap 33 through the agency of the cable 40a and 40b until the member 37 encounters an abutment (not shown). The spring 41 continues to be operative and the pulley 38 rotates with respect to the member 37 which can no longer rotate. This rotation of the pulley 38 causes pulley the cable 40a or 40b to be wound thereon. The first stage (rotation of the member 37) causes the harness to pass from the position 7A to the position 7B shown in FIG. 7 (rotation of the rear strap 33), whereas the second stage (rotation of the pulley 38 alone) causes the passage of the harness from the position 7B to the position 7C in FIG. 7 (application of the mask).

To take off the mask equipped with the harness, it is sufficient to exert a strong pull on the mask in the forward direction and this causes the pulley 38 to rotate in the opposite direction and stress the spring 41 until the ball 49 locks the pulley 38 in position, the return spring 47 having returned the shaft 45 to its locking position.

In the case of the upper part of FIG. 7, a second spring 42 stronger than the spring 41 is provided, and adapted to ensure an energetic tightening of the mask against the face after the mask positioning tightening effected as explained hereinbefore. In this first stage, the spring 42 is inoperative, since the action of the ball 50 connects it to the pulley 48. When the pulley 48 has reached a predetermined position, the ball 50 encounters a cavity which allows it to retract, in the same way as the ball 49. The member 44 is then released from the pulley 38 and tends to rotate and unwind the spring 42. It is prevented from doing so in the known manner by a ball 51 (FIG. 9) which is wedged between two eccentric ramps which decrease the clearances and lock the member 44 on the fixed spindle 43. A conventional pawl device may also be employed. The action of the spring 42 is then added to the action of the spring 41 and drives the pulley energetically, since the travel is short and the spring 42 may be powerful within a small volume. To take off the mask equipped with the harness, the procedure is the same as before and this restresses the spring 42 and produces the same movements as those described hereinbefore.

The device shown in the left part of FIG. 8 (shaft 45, spring 47, ball 49) can be employed for locking and unlocking the pulleys 24 and 25 shown in FIGS. 5 and 6.

In any case, the front strap is advantageously elastically secured at its ends so as to allow an adaptation to the various shapes of the heads of the users.

Although the invention has been described with reference to particular embodiments, it must be understood that the invention is not intended to be limited thereto and various modifications may be made therein without departing from the scope of the invention as defined in the accompanying claims.

What I claim is:

1. A rapidly positionable face mask harness comprising

at least one guide case;

means operable to secure a face mask to said guide case;

at least one semi-rigid strap, said strap having a first portion operable to engage the rear of the head of a wearer and a second portion, transverse to said first arm portion, for passing along the side of a wearer's head, said second portion being slideably mounted in said guide case and of a length sufficient to permit easy passage of said strap over the head of a wearer when said mask is in position;

tension means urging said strap into sliding motion through said guide case from a first position in which said first portion of the strap passes easily over the head of a wearer to a second position in which said first portion engages the rear of the head of a wearer; and

releasable locking means operable to maintain said strap in said first position in a state of tension.

2. A harness according to claim 1 wherein there are two of said guide cases disposed substantially symmetrically on either end of a semi-rigid U-shaped support operable to pass over the top of the head of a user upon positioning of said mask, said semi-rigid strap also being of a U-shaped configuration with two second arm portions, each of said arm portions being slideably mounted in one of said guide cases.

3. A harness according to claim 2 wherein said semi-rigid U-shaped strap is pivotably mounted relative to said U-shaped support about an axis passing through each of said guide cases.

4. A harness according to claim 1 wherein there are two guide cases disposed substantially symmetrically on either side of the harness and said strap is of a U-shaped configuration with two second arm portions each slideably mounted in one of said guide cases.

5. A harness according to claim 4 wherein said tension means comprise at least one elastic strap fixed to the ends of said semi-rigid strap.

6. A harness as claimed in claim 5, wherein said semi-rigid strap and said elastic strap are constituted by a single elastic strap having a stiffened part.

7. A harness according to claim 4 comprising two elastic straps whose ends are respectively fixed to the respective ends of the semi-rigid strap.

8. A harness according to claim 1 wherein said locking means comprise a retractable pin disposed on said guide case for engagement with a recess in said second portion of said semi-rigid strap.

9. A harness according to claim 8 wherein said pin is urged into engagement with said recess by spring means.

10. A harness according to claim 9 including means for manually retracting said pin from engagement with said recess.

11. A harness according to claim 1 including means operable to brake the initial sliding motion of said strap upon release of said locking means.

12. A harness according to claim 1 wherein said semi-rigid strap is slidably mounted in said guide case through a cable to a rotating cam member providing varying tensional force as said semi-rigid strap slides through said guide case.

13. A harness according to claim 1 wherein said tension means includes a pulley and a cable, one end of

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cable being wound about said pulley and the other end being attached to said semi-rigid strap, and spring means urging the pulley into cable winding rotation upon release of said locking means.

14. A harness according to claim 1 including means 5

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operable to effect the release of said means upon the correct application of the harness so that the mask is on the face of the user.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,792,702 Dated February 19, 1974

Inventor(s) Rene Delest

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, insert:

-- Claims priority from French patent application
71 12 823, filed April 9, 1971 in France. --

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents