March 5, 1963 W. G. PATE 3,079,917

OXYGEN MASK ASSEMBLY AND ADJUSTABLE SUSPENSION MEANS THEREFOR

Filed March 21, 1958 2 Sheets-Sheet 1

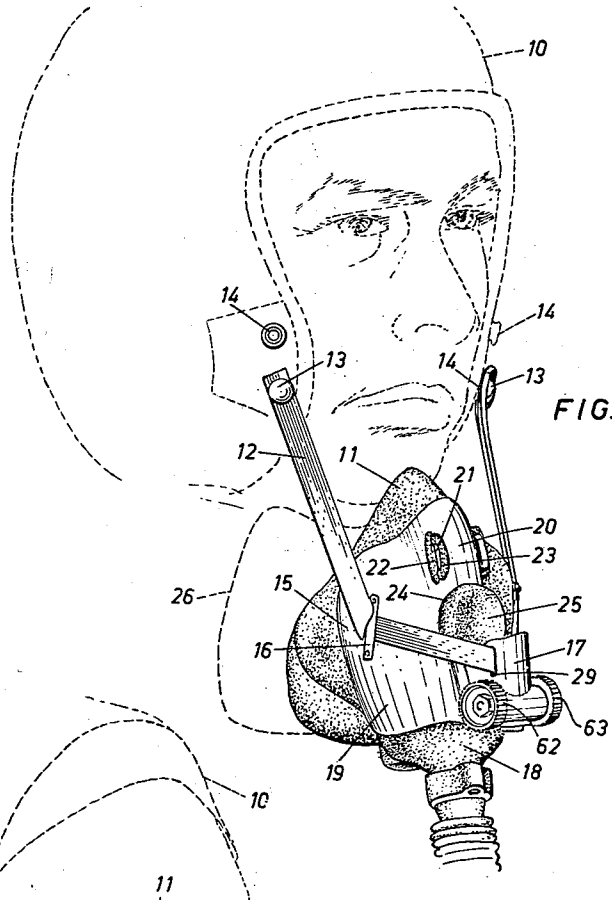

FIG. 1

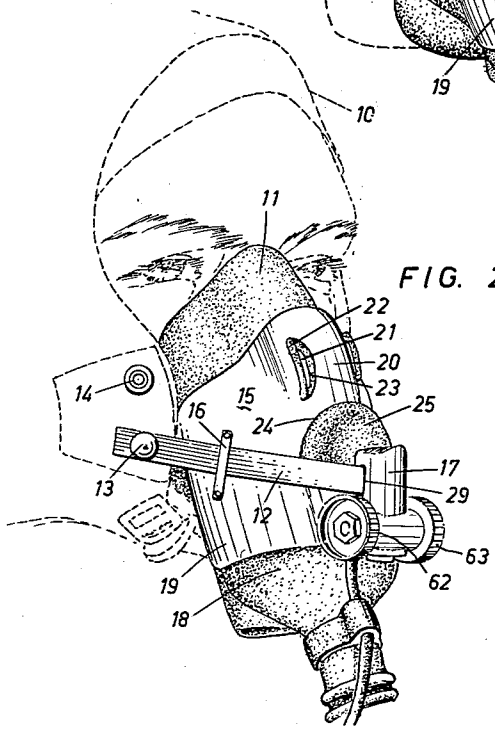

FIG. 2

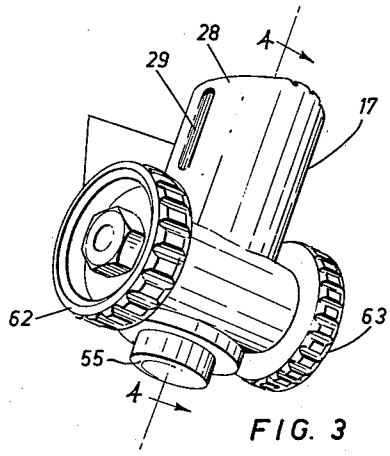

FIG. 3

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March 5, 1963 W. G. PATE 3,079,917

OXYGEN MASK ASSEMBLY AND ADJUSTABLE SUSPENSION MEANS THEREFOR

Filed March 21, 1958 2 Sheets-Sheet 2

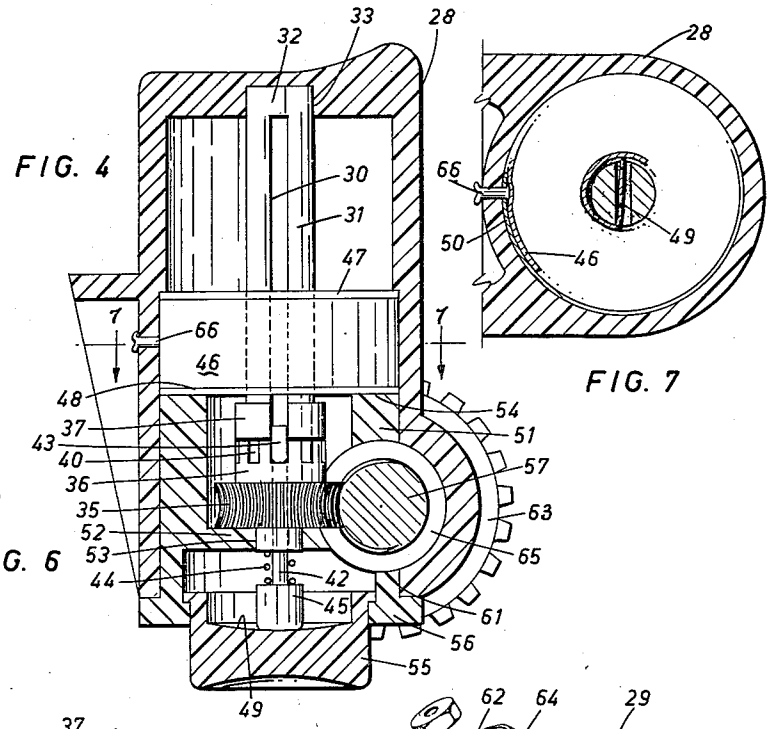

FIG. 4

FIG. 7

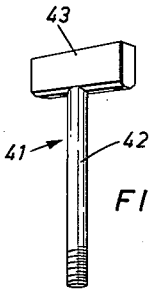

FIG. 6

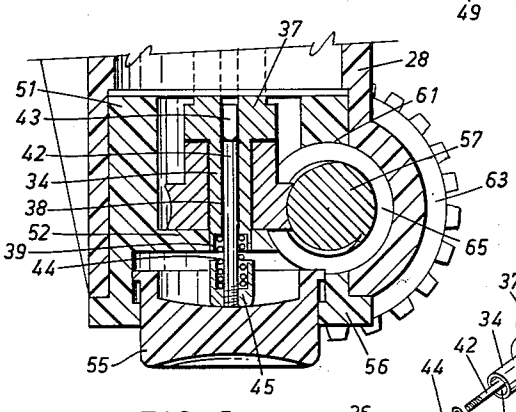

FIG. 5

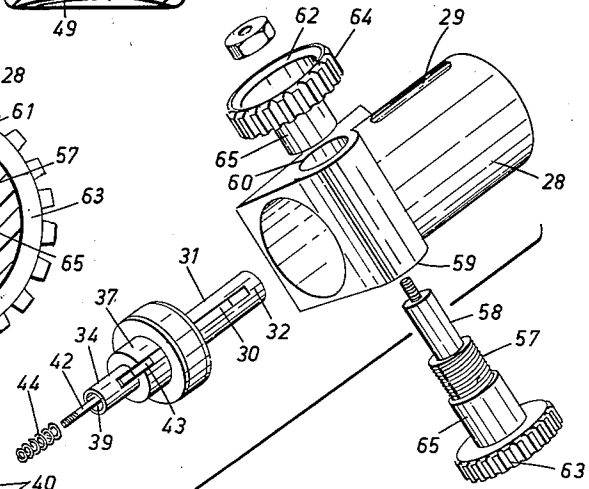

FIG. 8

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3,079,917

OXYGEN MASK ASSEMBLY AND ADJUSTABLE SUSPENSION MEANS THEREFOR

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Filed Mar. 21, 1958, Ser. No. 722,987
10 Claims. (Cl. 128—146)

This application relates generally to oxygen mask assemblies and more particularly to means for adjusting oxygen masks worn by flyers.

The necessity for oxygen masks for pilots and aircrew flying at alitude is well known. Generally an oxygen mask forms a part of a flyer's equipment. It is not necessarily worn all the time but is usually available so that it may be quickly donned. It is also general to place the pilot's or aircrew's microphone in the oxygen mask so that communications will not be interrupted when masks have to be worn. For this reason it is usual for the mask to be suspended fairly close to the face when it is not in use. When the mask is being worn at low altitudes where a certain amount of oxygen supply is required, it is not essential that the mask fit too tightly against the face, but, as the altitude increases it becomes necessary that the mask be fitted snugly to the face to prevent the escape of oxygen under conditions known as pressure breathing. For this reason, means has to be provided whereby the mask may be adjusted to fit comfortably and securely on the wearer's face.

In masks of the prior art, it has been known to attach the mask to the flyer's helmet by means of a strap which can be fastened to each side of the helmet. The flyer adjusts the strap so that the mask fits snugly on his face. When it is not required to use the mask the flyer unbuckles it at one side and it hangs from the buckle on the other side. When the mask is not being worn and if the flyer wishes to use the microphone, the mask has to be held temporarily in front of the face. When the flyer places the mask in position for using oxygen, it is immediately clamped tightly to his face in the position required for pressure breathing at high altitudes mentioned above, which is not always necessary. In some types of masks, wire connections between each side of the mask and the helmet are used, and a turnbuckle adjustment is provided at each side. Other masks are provided with a ratchet like adjustment at each side, and when the mask is to be positioned for use the ratchets on both sides of the helmet have to be adjusted to position the mask comfortably on the face. Such adjusment is not convenient and where wire supports are used, the supports form an awkward obstruction when the mask is not in use.

It is thus an object of this invention to provide a means for adjusting an oxygen mask whereby the oxygen mask may be suspended below the face in the ready position and quickly adjusted to the in-use position.

It is a further object of this invention to provide a readily self-adjusting means for supporting an oxygen mask whereby the oxygen mask may be moved quickly from a suspended position below the operator's face to a secured in-use position without prior adjustments by the operator.

It is also an object of this invention to provide a means for adjusting an oxygen mask whereby the tension of the supports for the oxygen mask may be readily adjusted when the mask is in the in-use position.

It is a further object of this invention to provide means whereby such adjustment may be made simply with one hand, and whereby the tension of the supports on each side of the face are simultaneously adjusted.

It is a further object of this invention to provide an oxygen mask assembly having supporting and adjusting means whereby the mask may be suspended in a ready position substantially centrally and below the operator's face, and

may be speedily adjusted to an in-use position by means of a single handed operation without the necessity for prior adjustment of the support means to suit the individual operator.

The invention generally concerns an oxygen mask assembly adapted to be applied to an operator's face comprising in combination: a face engaging oxygen mask; a pressure plate attached to said mask; adjustment means mounted upon said pressure plate; and suspension means for said mask said suspension means having a flexible portion engaging said adjustment means.

Other objects and advantages of the invention will become apparent from a consideration of the following description in conjunction with the drawings in which:

FIGURE 1 shows a flyer wearing a helmet and an oxygen mask assembly and adjustable suspension means of the invention in the loose or ready position;

FIGURE 2 shows a flyer wearing a helmet and an oxygen mask assembly and adjustable suspension means of the invention in the in-use position;

FIGURE 3 shows an enlarged view of the adjustment means of the invention;

FIGURE 4 shows a partial sectional view of the adjustment means along the line 4—4 of FIGURE 3;

FIGURE 5 shows a detailed sectional view of the gear portion of the adjustment means of FIGURE 4;

FIGURE 6 shows the T-bar release for the adjustment means;

FIGURE 7 shows a cross section of the adjustment means along the line 7—7 of FIGURE 4; and

FIGURE 8 shows an exploded view of the adjustment means of the invention.

Referring to the drawings, an operator is shown wearing a flying helmet **10**. Flying helmets differ, but the invention is equally usable with the hard type or crash helmet shown in FIGURE 1, or the soft helmet, often used as an inner helmet shown in part of FIGURE 2.

Oxygen mask **11** is suspended from flying helmet **10** by means of suspension means **12** which may be in the form of a webbing tape. Suspension means **12** is provided at each end with attachment means **13** which may be in the form of a buckle or press stud, and is attachable to corresponding press stud or buckle attachment means **14** on the flying helmet **10**. Oxygen mask **11** is provided with pressure plate **15** which conforms to the outer shape of oxygen mask **11** and fits thereover. Pressure plate **15** is provided with guide means **16** on either side thereof. Suspension means **12** passes through guide means **16** to adjustment means **17** which is mounted on pressure plate **15**, by means of screws (not shown).

Oxygen mask **11** is adapted to fit closely over the operator's nose and mouth. It is provided with a downwardly depending oxygen inlet portion **18**. Pressure plate **15** conforms closely to the shape of oxygen mask **11** and the rearward edges of the lower portion **19** of pressure plate **15** fit around oxygen inlet portion **18** of mask **11**. The upper portion **20** of pressure plate **15** is provided with outwardly depending tabs **21**. Oxygen mask **11** is provided with outwardly extending loop portions **22**. Pressure plate **15** is mounted upon oxygen mask **11** by sliding the lower portions **19** over oxygen inlet portion **18**. Forwardly extending tabs **21** on pressure plate **15** are formed leaving slot-like holes **23**. Loops **22** on oxygen mask **11** extend forwardly through slots **23** and are snapped over tabs **21** to hold pressure plate **15** in cooperation with oxygen mask **11**. Pressure plate **15** is further provided with a cut-out portion **24** to allow for the forward projection of the microphone housing **25** in the oxygen mask **11**. It is not essential that pressure plate **15** be provided with cut-out portion **24**, it could instead be molded to fit over the projection in the front of oxygen mask **11**. Nevertheless, it is practical to pro-

vide a cut-out portion so as to save as much weight as possible. Guide means **16** are provided one on either side of pressure plate **15**. These guide means may be in the form of small loop brackets which may be attached to pressure plate **15** or may be punched out therefrom in any suitable manner. Suspension means **12** passes through guide means **16** to adjustment means **17**, the operation of which will be described in further detail hereafter.

The use of pressure plate **15** conforming to the shape of oxygen mask **11** presents advantages, in that the upper portion **20** which is bent inwardly to conform to the shape of the nose portion of the mask, prevents the mask from spreading outwardly when it is pressed close to the operator's face under pressure breathing conditions. It is thus possible to ensure a better contact of the mask with the operator's face. Although oxygen mask **11** may be of conventional design, it will be noted that it is possible because of the better contact ensured by use of pressure plate **15** to do away with the face engaging side flanges often used. This enables a saving in the weight and size of the oxygen mask.

Adjustment means **17** is mounted upon pressure plate **15**. Outer casing **28** of adjustment means **17** is provided with slots **29** in each side. Suspension means **12** passes through slots **29** in outer casing **28** and through slot **30** in adjustment spool **31** supported within outer casing **28**. The end **32** of adjustment spool **31** is designed to be rotatably supported in bearing portion **33** in outer casing **28**. The other end **34** of spool **31** is adapted to rotatably carry worm gear **35**, and attached hub **36**. Hub **36** abuts shoulder **37** on spool **31**, hub **36** and shoulder **37** being of the same diameter. End **34** of spool **31** projects beyond worm gear **35**, and is provided with an internal axial bore **38** which extends to the end of slot **30**. The outer end **39** of axial bore **38** is of increased diameter for reasons which will become apparent as the description proceeds. The face of hub **36** which abuts shoulder **34** is provided with diametrical slots **40** of width substantially equal to slot **30**. T-bar **41** consists of rod **42** provided with T-head **43**. T-bar **41** is inserted in slot **30** of spool **31** and rod **42** is inserted in bore **38**, and moved longitudinally into position. In the assembled position head **43** rides in slot **30** and engages one of diametrical slots **40**. The end of rod **42** projects beyond the end **34** of spool **31**. A compression spring **44** is provided having one end supported in outer end **39** of bore **38**. Cap **45** is attached by suitable means to the end of rod **42** and supports the other end of spring **44**. The length of rod **42** is such that cap **45** may be depressed against the force of spring **44** so as to release head **43** from engagement with diametrical slot **40**. In this position, spool **31** will be free to rotate independently of worm gear **35**.

Spring means in the form of a helical strip spring **46** is wound about spool **31** adjacent collar **34** on the opposite side to worm gear **35**. Washers **47** and **48** are placed on either side of spring **46** and serve both to protect it and to help support spool **31** as hereinafter described. The inner end **49** of spring **46** is passed through slot **30** and retained therein by any convenient means, usually by reversing the end in an S form. The outer end **50** of spring **46** is fastened to outer casing **28** in the assembled position as by pin **66**. In order to retain the assembly so far described in outer casing **28**, end casing **51** is provided adapted to fit closely within the end of outer casing **28**. End casing **51** is provided with internal flange **52** having a hole **53** therethrough. Hole **53** is adapted to rotatably support the end **34** of spool **31** projecting beyond worm gear **35**. Washer **48** abuts the inner end **54** of end casing **51**. Washers **47** and **48** are of the same outside diameter as end casing **51** and thus fit closely within outer casing **28** forming additional support for spool **31**. As previously stated the end **32** of spool **31** is supported within bearing portion **33** in outer casing **28**. Push button **55** made of plastic or other suitable material is snap fitted into the outer end **56** of end casing **51**. The inner side **49** of push button **55** engages the end of cap **45**.

When the assembly and end casing **51** are inserted in outer casing **28**, worm **57** supported upon worm shaft **58** is inserted through holes **59**, **60** in outer casing **28**, and corresponding cylindrical cut away portion **61** in end casing **51**. Worm **57** is adapted to engage worm gear **35** which is adjacent flange **52** and the ends of worm shaft **58** project through holes **59**, **60** in outer casing and are adapted to receive adjustment knobs **62**, **63**. These knobs are similar. Each knob is provided with a suitable knurled flange **64**, and has an inwardly projecting cylindrical portion **65** of reduced diameter. Portions **65** are adapted to be rotatably supported within holes **59** and **60** of the outer casing and rotatably engage cut away portion **61** of end casing **51**. Thus when knobs **62** and **63** are inserted, the inwardly projecting portions **65** thereof lock end casing **51** against axial or rotary movement. The ends of worm shaft **58** pass through knobs **62** and **63** which are non-rotatably secured thereto, as by means of lock nuts.

Rotation of either of knobs **62** or **63** will cause spool **31** to be rotated by virtue of the cooperation of worm **57**, worm gear **35** and the engagement of head **43** in slots **30** and **40**. Upon depression of push button **55**, head **43** will be pushed out of engagement with slot **40** and spool **31** will be free to rotate under the influence of spring **46**.

To assemble suspension means **12** on spool **31**, it is simply necessary to wind up spring **46** by means of adjustment knobs **62** or **63**, until spring **46** is compressed. Suspension means **12** is then fed through slots **29** in outer casing **28** and slot **30** in spool **31**. The ends of suspension means **12** are passed through respective guide means **16** and the press studs or buckles are attached. It should be seen that equal lengths of suspension means **12** project from either side of adjustment means **17**. Push button **55** may then be depressed whereupon spring **46** will unwind causing spool **31** to rotate and wind up suspension means **12**. The press studs or buckles will engage guide means **16** and prevent suspension means **12** from being wound too far. Although one way of constructing adjustment means **17** has been described it will be appreciated that there are many variations which could be made in the manner of manufacture. For example, a moulded outer casing **28** provided with suitable internal support flanges could be made in two halves which could be screwed together.

In operation the invention works as follows: Attachment means or press studs **13** are attached to press studs **14** on flying helmet **10**. Push button **55** is depressed thus releasing head **43** of T-bar **41** from engagement from slot **40**. Adjustment spool **31** is now free to rotate against the force of spring means **46**. With push button **55** depressed the oxygen mask assembly may be drawn away from the helmet. When push button **55** is released head **43** of T-bar **41** will be urged into engagement with one of slots **40** by spring **44** thus locking adjustment spool **31** and worm gear **35** together. Further rotation of adjustment spool **31** under the influence of spring means **46** will thus be prevented by reason of the engagement of worm gear **35** with worm **57**. When the helmet and attached oxygen mask assembly is donned the oxygen mask assembly will be suspended by suspension means **12** centrally below the wearer's face. The position of the oxygen mask known as the ready position is convenient in that the wearer may readily speak into the microphone in the oxygen mask without necessarily holding the oxygen mask up to his face. When it is desired to use the oxygen mask for the purposes of breathing at altitude, all that is required is to depress push button **55** which will release adjustment spool **31** to rotate under the influence of spring means **46**. Spring means **46** will immediately urge spool **31** to rotate in a direction so as to wind up or shorten suspension means

12 thus raising the oxygen mask to the wearer's face, the exact positioning of the oxygen mask being guided by the operator's hand. Upon releasing push button 55 head 43 will engage one of slots 40 as previously described and maintain the oxygen mask assembly in its new position.

Spring means 46 is designed to be of a strength sufficient to take up all slack in the suspension means 12, and hold the oxygen mask assembly firmly against the face of the operator without exerting undue pressure. Once the oxygen mask assembly is positioned on the face of the operator further adjustment to increase or decrease the pressure of the oxygen mask on the face may be made by means of rotating adjustment spool 31 manually. This is effected by turning one of adjustment knobs 62 or 63 which in turn cause worm 57 and worm gear 35 to rotate. The rotary movement of worm gear 35 is transmitted to adjustment spool 31 by means of head 43 of T-bar 41. Thus the oxygen mask assembly may be positioned quickly on the operator's face and by means of pushing push button 55 the suspension means 12 will be automatically adjusted to retain the mask in the new position. The final pressure may be swiftly adjusted by means of single handed operation in adjusting one of knobs 62 or 63. To remove the oxygen mask assembly from the face it is simply necessary to push button 55 and draw the assembly away from the face to any distance required. Push button 55 is then released and the assembly will remain in the new position. The action of drawing the oxygen assembly away from the operator's face will of course cause suspension means 12 to unwind from adjustment spool 31. The resultant rotation of adjustment spool 31 will be against the force of spring means 46 and will wind up spring means 46 and increase its tension so that it will be ready to rewind suspension means 12 on adjustment spool 31 when required.

When the oxygen mask assembly is worn in the ready or suspended position, it is conveniently located centrally below the face and by virtue of the fact that suspension means 12 is flexible and is attached to the lower part of the helmet 10 the assembly permits freedom of movement of the operator's head, at the same time remaining in a position whereby it may be instantly adjusted for use. The oxygen mask assembly of the invention provides many advantages. It is adjustable to any operator and suspension means 12 do not have to be separately adjusted as in many conventional assemblies. Also, the mask assembly requires no supports other than suspension means 12 to ensure adequate facial contact. The positioning of adjustment means 17 is such that pressure plate 15 is urged squarely towards the area of the face covered by the mask 11.

The outer casing 28 and end casing 51 of adjustment means 17 and adjustment spool 31 are preferably made of nylon or similar material. The advantage of such a construction is that it is light, durable and substantially inert. Moreover, the rotatable bearing contacts will not be likely to seize, or require lubrication. The gears may be of cadmium plated steel or other suitable material.

Pressure plate 15 is of an aluminum alloy. It may, however, be made of fiber-glass or nylon suitably strengthened. To save weight, pressure plate 15 can be suitably perforated. Spring means 46 may be of any suitably durable and resilient material such as Phosphor bronze or beryllium copper.

It will be understood that the invention is not to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the scope of the invention, as defined in the appended claims.

What I claim as my invention is:

1. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; constraining means mountable on said mask to constrain at least a portion of said mask against distortion; means retaining said mask and said constraining means in associated relationship; an adjustment spool rotatably mounted on said constraining means; a strap for suspending said mask adjacent the face of an operator; said strap engaging said spool whereby upon rotation of said spool in one direction said strap is taken-up thereon and upon rotation of said spool in the opposite direction is unwound therefrom to alter the effective length of said strap and regulate the position of said mask relative to the face of an operator.

2. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate adapted to fit closely on said oxygen mask; means retaining said oxygen mask and pressure plate in close co-operation; an adjustment spool rotatably mounted on said pressure plate; a strap for suspending said mask adjacent the face of an operator; said strap engaging said spool whereby upon rotation of said spool in one direction said strap is taken-up thereon and upon rotation of said spool in the opposite direction is unwound therefrom to alter the effective length of said strap and regulate the position of said mask relative to the face of an operator; and guide means on said pressure plate for said strap.

3. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate adapted to fit closely on said oxygen mask; means retaining said oxygen mask and pressure plate in close cooperation; an adjustment spool rotatably mounted on said pressure plate; a strap for suspending said mask adjacent the face of an operator; said strap engaging said spool whereby upon rotation of said spool in one direction said strap is taken-up thereon and upon rotation of said spool in the opposite direction is unwound therefrom; and a manually rotatable gear train normally engaging said adjustment spool for manual rotation thereof to adjust said mask relative to the face of an operator.

4. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate adapted to fit on said oxygen mask; means retaining said oxygen mask and pressure plate in close relationship; a strap for suspending said mask adjacent the face of an operator; said strap engaging said spool whereby upon rotation of said spool in one direction said strap is taken-up thereon and upon rotation of said spool in the opposite direction is unwound therefrom; spring means co-operating with said adjustment spool and urging rotation thereof to take-up said strap; gear means normally engaging said spool to resist automatic rotation thereof; and manually disengageable means connecting said spool and said gear means.

5. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate adapted to fit on said oxygen mask; means retaining said oxygen mask and pressure plate in close relationship; an adjustment spool rotatably mounted on said pressure plate; suspension means having a flexible portion engaging said adjustment spool, and windable thereon; spring means cooperating with said adjustment spool and urging rotation thereof to wind up said suspension means; manually rotatable means normally engaging said spool; manually disengageable means connecting said spool and said manually rotatable means; and means resisting automatic rotation of said manually rotatable means.

6. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate adapted to fit on said oxygen mask; means retaining said oxygen mask and pressure plate in close relationship; an adjustment spool rotatably mounted on said pressure plate; suspension means having a flexible portion engaging said adjustment spool and windable thereon; spring means cooperating with said adjustment spool and urging rotation thereof to wind up said sus-

pension means; a worm gear rotatable independently of said spool and coaxial therewith; manually disengageable means connecting said spool and said worm gear; a worm engaging said worm gear; and means for manually rotating said worm.

7. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate conforming closely to the shape of said mask and fitting thereon; means retaining said mask and said pressure plate in close cooperation; adjustment means on said pressure plate; a first rotatable element within said adjustment means; flexible suspension means engaging said rotatable element and windable thereon; spring means urging rotation of said first rotatable element; a second rotatable element; releasable means normally coupling said first and said second rotatable elements; means manually operable to release said releasable means from normal engagement with one of said rotatable elements thereby allowing independent rotation of said elements with respect to each other; and means manually operable to effect rotation of said second rotatable element said means resisting independent rotation of said second rotatable element.

8. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate conforming closely to the shape of said mask and fitting thereon; retaining means maintaining said mask and pressure plate in close cooperation; guide means on said pressure plate; adjustment means fixed to said pressure plate; a first rotatable element within said adjustment means; a slot in said first rotatable element; a flexible suspension means passing through said guide means and said slot in said first rotatable element; spring means urging rotation of said first rotatable element; a second rotatable element independently rotatable of said first rotatable elment; means manually operable to effect rotation of said second rotatable element and resisting independent rotation of said second rotatable element; movable engagement means connecting said first and said second rotatable elements; spring means normally urging said movable engagement means into position coupling said first and second rotatable elements; and means manually operable to move said movable engagement means to disengage said first and second rotatable elements.

9. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate conforming closely to the shape of said mask and fitting thereon; cooperating loops and tabs on said mask and said pressure plate respectively retaining said mask and pressure plate in close cooperation; guide means on said pressure plate; adjustment means mounted on said pressure plate; a rotatable element rotatably supported in said adjustment means; a slot in said rotatable element; a flexible suspension means passing through said guide means and said slot in said rotatable element; helical spring means urging rotation of said rotatable element; a worm gear rotatably mounted on said rotatable element, a hub on said worm gear; a plurality of slots in said hub; movable means engaging said slot in said rotatable element and at least one of said slots in said hub; spring means normally urging said movable means into engagement with said slots; means manually operable to disengage said movable means from said at least one slot in said hub; whereby said rotatable element is independently rotatable of said worm gear and said hub; and manually rotatable means connecting said worm whereby rotation of said worm gear may be effected by an operator.

10. An oxygen mask assembly adapted to be applied to an operator's face comprising in combination: an oxygen mask; a pressure plate adapted to fit closely on said oxygen mask; means retaining said oxygen mask and pressure plate in close co-operation; an adjustment spool rotatably mounted on said pressure plate; a strap for suspending said mask adjacent the face of an operator; said strap engaging said spool whereby upon rotation of said spool in one direction said strap is taken-up thereon and upon rotation of said spool in the opposite direction is unwound therefrom; a worm gear having a hub normally engaging said spool; a manually rotatable worm for rotating said worm gear; and manually operable means for disengaging said worm gear and said spool.

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