Jan. 29, 1957 T. C. HUXLEY III, ET AL 2,779,329

ARTIFICIAL RESPIRATION APPARATUS

Filed June 17, 1953

FIG. 1

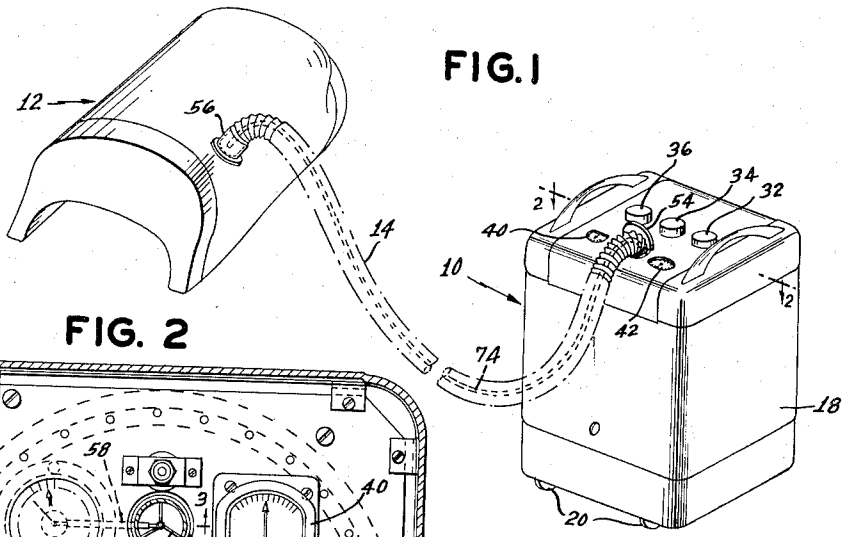


FIG. 2

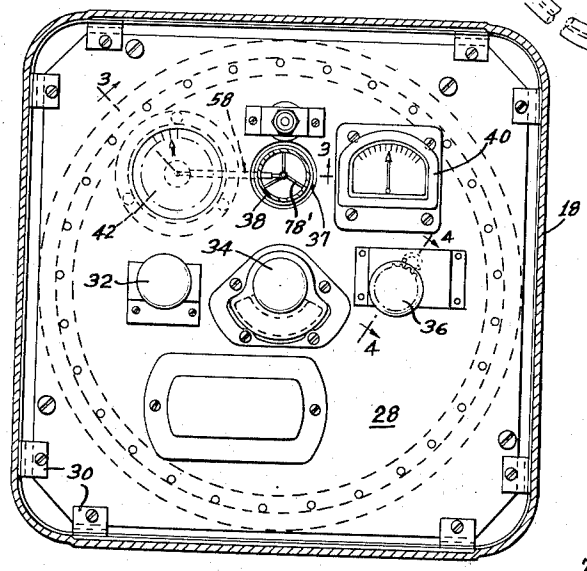


FIG. 4

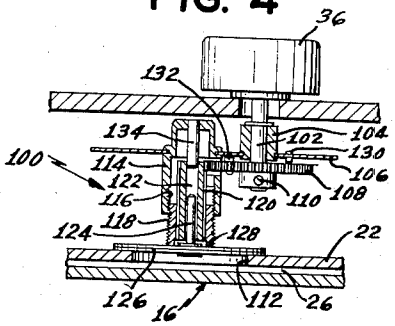


FIG. 3

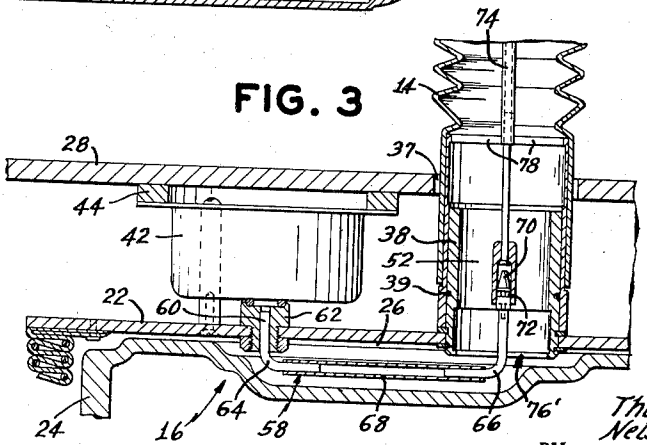
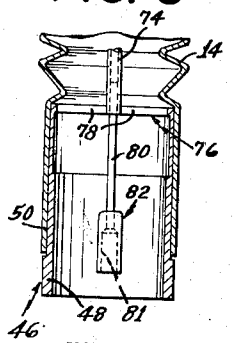


FIG. 5



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ARTIFICIAL RESPIRATION APPARATUS

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Application June 17, 1953, Serial No. 362,316

16 Claims. (Cl. 128—30)

This invention relates generally to improvements in artificial respiration apparatus and, more particularly, to improvements in artificial respiration apparatus of the portable type.

One object of the present invention is the provision, in artificial respiration apparatus having a pump and control unit adapted for operative association with a cuirass, of pressure-indicating means positioned in close proximity to the control unit with the pressure indicating means measuring pressure directly at the cuirass.

Another object of the present invention is the provision of pressure-indicating means of the aforenoted character having pressure transmitting means disposed in the conduit extending between the pump and cuirass, said pressure transmitting means being adapted for automatic connection with the pressure indicating means on the interconnection of the conduit and pump.

Another object of the present invention is the provision in a pump and control unit for respirators, of an improved control arrangement for controlling the discharge of air from the pumping chamber during the positive pressure phase of the pumping cycle.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawing which illustrates the best mode now contemplated by us for carrying out our invention:

Fig. 1 is a perspective view of the respirator pumping apparatus shown connected to a cuirass;

Fig. 2 is a sectional view, on an enlarged scale, taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view, on an enlarged scale, taken on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view, on an enlarged scale, taken on the line 4—4 of Fig. 2; and

Fig. 5 is a fragmentary sectional view of one end portion of the conduit.

The respirator pumping apparatus of the present invention is generally of the type shown and described in the copending application of Thomas C. Huxley III for Pump and Control Unit for Respirators, Serial No. 295,181, filed June 24, 1952, and assigned to the assignee of the present invention. Thus the respirator pumping apparatus 10 is adapted to periodically supply air to and withdraw air from the cuirass 12 which is operatively connected to the pumping apparatus 10 by means of the conduit 14. The cuirass 12 may be any of the well known types, for example the type shown and described in the patent to Thomas C. Huxley III, No. 2,466,108, issued April 5, 1949, for Artificial Respirator. It will be understood that the cuirass 12 is adapted to be fitted to a patient, and when so fitted, the pumping apparatus 10 is adapted to periodically supply air to and withdraw air from said cuirass to simulate normal respiration. Accordingly, the pumping apparatus 10, when operatively associated with the cuirass 12, alternates between partial evacuation and normal pressure of the air within the cuirass at a controlled and variable rate to successfully

simulate normal respiration. The apparatus 10 is structurally similar to the corresponding apparatus of the aforereferred to copending application and differs therefrom in the respects to be fully described in detail hereinafter.

The apparatus 10 comprises a bellows type pump 16 which has means integrated therewith for controlling the amount of negative pressure or suction applied to the cuirass 12 and for controlling the amount of positive pressure applied to said cuirass. The pumping apparatus 10 is housed in a suitable casing 18, the latter having casters 20 at its lower end to facilitate the movement of the apparatus 10 on a supporting surface. The pump 16, which is preferably of the bellows type, comprises a fixed head 22 and a piston 24 relatively movable thereto, said piston being mounted for reciprocation in the manner fully shown and described in the aforereferred to copending application. The pump head 22 is in fixed relation with the casing 18 and it will be readily apparent that there is defined between the head 22 and piston 24 a sealed pumping chamber 26. The apparatus 10 is provided with an instrument panel 28 which is supported by the housing 18 through the intermediation of suitable brackets 30. The instrument panel 28 is provided with a power switch 32, a negative pressure control knob 34, a positive pressure control knob 36, an opening 37 leading to a fitting 38 which is adapted for the reception of a companion portion of the conduit 14, and an indicator 40 graduated to indicate respirations per minute.

Pursuant to the present invention there is provided a pressure gage 42 which is mounted on the instrument panel 28 in close proximity to the negative and positive pressure control knobs 34 and 36 aforenoted. The pressure gage 42 is generally of the type shown and described in the aforereferred to copending application and is mounted relative to the instrument panel 28 in any conventional manner, there being preferably interposed between said instrument panel and pressure gage a suitable gasket 44. In accordance with the present invention the pressure gage 42 is positioned in close proximity to the operating controls as aforedescribed with said pressure gage being adapted to measure pressure directly at the cuirass 12 in a manner now to be described in detail. The conduit 14 which is adapted to connect the apparatus 10 to the cuirass 12 in fluid flow relation therewith is preferably of flexible and resilient construction and in the illustrated embodiment said conduit is of the corrugated type. As best shown in Figs. 3 and 5, the terminal ends 46 of the conduit 14, which are structurally identical, are in the form of fittings, the latter comprising a preferably metallic coupling 48 having a portion receivable in end portion 50 of the conduit 14 in fluid sealing relation therewith. As aforenoted, the fittings 46 of the conduit 14 are structurally identical whereby both ends of said conduit may be interchangeably associated with the apparatus 10 and cuirass 12 in a manner to be described in detail hereinafter. It is to be noted that fitting 38 defines a passage 52 which is in fluid communication with the pumping chamber 26. The fittings 46 and 38 are formed complementary to each other and are adapted for releasable interengagement in fluid sealing relation. The fittings 38 and 46 are adapted for association by a friction fit in fluid sealing relation, said fitting 38 being provided with a sealing ring 39. The opening 37 in the instrument panel 28 may have associated therewith an openable cover 54, and said cover may be of the type fully shown and described in the aforereferred to copending application. The cuirass 12 is provided with the fitting 56 which is structurally similar to fitting 38 and which defines a passage which is in fluid communication with the interior of said cuirass. The fitting 56 is thus

formed complementary to the fittings 46 of the conduit 14 aforedescribed and is adapted for frictional interengagement with one of the fittings 46 for establishing fluid communication between the conduit 14 and the cuirass 12. Thus in practice one fitting 46 of the conduit 14 will be operatively associated with the pumping apparatus 10 and an opposite fitting of said conduit will be operatively associated with a cuirass 12 in the aforedescribed manner whereby said conduit is effective to provide fluid communication between the pumping chamber 26 of apparatus 10 and the interior of the cuirass 12.

The pressure gage 42 is provided with a pressure transmitting tube portion 58 which extends in the pumping chamber 26 and to the region of fitting 38, the portion 60 of said tube portion extending into the fitting 62 which is secured to the head 22 in any suitable manner. The tube portion 58 includes the elbow fitting 64 and 66 which are in fluid communication with each other by means of the connecting tube portion 68 which is positioned in the pumping chamber 26. Part of the fitting 66 extends into the passage 52 defined by the fitting 38 and terminates in a free end portion 70 which is constituted by a fitting which is adapted for a purpose which will be fully described hereinafter. Thus the fitting 70 is constituted by a tapered end portion of fitting 66 and is provided with a peripherally extending groove having a sealing ring 72 positioned therein. Thus the tube portion 58 is in fluid flow relation with the pressure indicating gage 42 and terminates in a free end portion constituted by the fitting 70 which is disposed in the region of the fitting 38. The fitting 66 is supported by spider 76' having radially extending arms 78' which are integral with fitting 38 so that fitting 70 is disposed and supported substantially centrally of fitting 38.

Extending longitudinally in the conduit 14 is a pressure transmitting tube 74 which may be formed of any suitable flexible material. In order to support the pressure transmitting tube 74 in the conduit 14 substantially centrally thereof at longitudinally spaced points there are provided supporting spiders 76 having radially extending arms 78, said arms being integral with couplings 48. In the illustrated embodiment two such spiders 76 are shown for supporting end portions of the pressure transmitting tube 74 relative to the conduit 14. The tube 74 is provided with a tube part 80 at its end portions, each of said tube parts terminating in a fitting 82 which is formed complementary to the fitting 70 of the pressure gage tube portion 58. It is to be noted that both end portions of the pressure transmitting tube 74 are structurally similar whereby either end portion of said pressure transmitting tube may be operatively associated with the fitting 70 of tube portion 58 in a manner to be described hereinafter. The fittings 82 of the tube 74 are formed complementary to the fitting 70 and are adapted to be connected therewith in fluid sealing relation whereby to provide a pressure transmitting passage from the cuirass 12 to the pressure gage 42. The aperture 81 of fitting 82 is dimensioned complementary to fitting 70 and is adapted for interengagement therewith in fluid sealing relation. Thus one end of the tube 74 is adapted for interconnection with the fitting 70 of the tube portion 58 and the opposite end thereof terminates in a free end portion or fitting in the region of the cuirass fitting 56 whereby the pressure gage 42 indicates the pressure at the cuirass 12.

As aforenoted, the fittings 82 are supported by means of the spiders 76 in a fixed position to the fittings 46 and on the interconnection of the conduit and casing fittings 46 and 38, respectively, one fitting 82 of the tube 74 will be automatically interconnected with its complementary fitting 70 associated with the pressure indicating gage 42 in the aforedescribed manner. From the above it will be apparent that the fittings 70 and 82 aforedescribed constitute means providing for the interconnection of one end of the tube 74 with the free end

portion 70 of the tube portion 58 on the interconnection of the conduit 14 with the apparatus 10. It is to be noted that the fittings 70 and 82 provide a releasable fluid sealing interconnection and similarly the connections between the conduit 14 and the apparatus 10 and cuirass 12 are of the releasable fluid sealing type. Thus the conduit fittings 46 at both ends of the conduit 14 are structurally similar and the tube fittings 82 are similarly structurally similar whereby it will be apparent that the conduit fittings may be interchangeably connected to the casing fitting 38 with the tube 74 interconnected with its companion tube portion 58. Thus the pressure gage 42 is positioned on the instrument panel 28 in close proximity to its associated controls with said pressure gage measuring pressure directly at cuirass 12 through the intermediation of the pressure transmitting tube 74 aforedescribed. The connection between the conduit 14 and the apparatus 10 will be effective to automatically connect the pressure transmitting tube 74 with the pressure gage 42 by means of the complementary fittings 70 and 82, aforedescribed.

Pursuant to the present invention there is provided an improved control arrangement for controlling the discharge of air from the pumping chamber 26 during the positive pressure phase of the pumping cycle. In most cases the application of positive pressure to the interior of the cuirass 12 is unnecessary, however when desired, the amount of positive pressure can be controlled through the pressure control valve 100 now to be described in detail.

With reference to Fig. 4, the pressure control valve 100 comprises a rotatably mounted actuating shaft 102 having a control knob 36 secured thereto and accessible at the instrument panel 28. The shaft 102 is mounted for rotation in the bearing part 104 which is secured to the bracket 106 in any desired manner. The inner end of the shaft 102 is provided with a gear 108 which is secured thereto by means of the pin 110. It will be apparent that the rotation of the knob 36 will be effective to concomitantly rotate the gear 108, the latter being adapted to control valve 100 in the manner to be described in detail hereinafter. The fixed head 22 is provided with a port 112 and the valve 100 controls the venting of said port in the manner shown and described in the aforereferred to copending application. Secured to the bracket 106, in any suitable manner, is a guide part 114 which is internally threaded as indicated at 116, said guide part being formed complementary to the externally threaded part 118. The part 114 is in fixed relation with the bracket 106 and the part 118 is rotatably mounted relative to the part 114 and is axially movable on the rotation thereof, it being understood that the parts 114 and 118 are threaded complementary to each other. In fixed relation with the part 118 and extending therein is a gear 120 which is formed complementary to the gear 108 and is in mesh therewith whereby it will be apparent that the rotation of the control knob 36 will be effective to concomitantly rotate part 118 to axially displace the latter relative to the port 112. Thus the part 118 and the gear 120 are in fixed relation whereby it will be apparent that the rotation of the gear 120 by means of the gear 108 will be effective to rotate part 118 and axially move the latter in a direction corresponding to the direction of rotation of the control knob 36. The gear 120 is centrally apertured therethrough as indicated at 122 for the reception of the guide shaft 124 which is freely movable in said aperture.

The guide shaft 124 has a valve member or diaphragm 126 secured at its lower end, said diaphragm being adapted to control the amount of air bypassed during the positive pressure phase of the pumping cycle. The lower end 128 of the part 118 is adapted to cooperate with adjacent upper face portions of the diaphragm 126 to control the bypass of air for thereby controlling the amount of positive pressure pumped by the pump 16. Ac-

cordingly the more the part **118** is positioned away from the head **22**, the greater will be the amount of air bypassed through said head and, if desired, the diaphragm **126** may be retained closed on the head **22** by rotating the control knob **36** the requisite amount. Thus the guide shaft **124** of the diaphragm **126** is freely movable axially and is limited in such axial movement by the head **22** in one direction and by the end **128** of the part **118** in an opposite direction. From the above it will be apparent that the amount of air bypassed from the pumping chamber **26** between the diaphragm **126** and the head **22** through the port **112** is under the control of the pressure valve **100**, the greater the amount of air so bypassed, the lower will be the positive pressure applied to the cuirass **12**. Thus the amount of air bypassed in this manner is under the control of the control knob **36** and associated mechanism, the latter being effective to axially position the part **118** relative to the diaphragm **126**. As fully illustrated and described in the aforereferred to copending application, during the suction or negative pressure phase of the pumping cycle the diaphragm **126** will be closed to the head **22** by the atmospheric pressure which will be greater than the pressure in the pumping chamber **26**. The bracket **106** is provided with a stop member **130** which is adapted to cooperate with the stop member **132** of gear **108** for limiting the rotation of the latter. It will be noted that the part **114** is provided with a depending shaft **134** which is formed complementary to the aperture **122** for guiding the gear **120** during the axial movement thereof. It is to be noted that gear **120** is of substantially smaller diameter than gear **108** whereby one revolution of the latter gear will rotate the former gear a plurality of revolutions to achieve correspondingly rapid axial movement of part **118**. Thus the pressure control valve **100** is positively operated by the gears as aforedescribed and functions to control the amount of positive pressure applied to the interior of the cuirass **12**.

While we have shown and described the preferred embodiment of our invention, it will be understood that various changes may be made in the present invention without departing from the underlying idea or principles of the invention within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent, is:

1. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass and a pressure indicating gage positioned remote from said cuirass, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said gage and the opposite end thereof terminating in a free end portion in the region of said cuirass whereby said gage indicates the pressure in said region, and means providing for the automatic releasable interconnection of the one end of said tube with said gage on the interconnection of said conduit with said pumping means.

2. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass and a pressure indicating gage positioned remote from said cuirass, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said gage and the opposite end thereof terminating in a free end portion in the region of said cuirass whereby said gage indicates the pressure in said region, and means providing for the automatic releasable interconnection of either of said tube ends with said gage on the interconnection of a companion end of said conduit with said pumping means.

3. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass and a pressure indicating gage positioned

remote from said cuirass, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said gage and the opposite end thereof terminating in a free end portion in the region of said cuirass whereby said gage indicates the pressure in said region, said one end of said tube being in a fixed relative disposition to a companion end of said conduit, means providing for the automatic interconnection of the one end of said tube with said gage on the interconnection of said conduit with said pumping means, and means for supporting said tube in said conduit at longitudinally spaced points in the region of the ends of said conduit.

4. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass and a pressure indicating gage positioned remote from said cuirass, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, a tube portion in fluid flow relation with said gage and terminating in a freed end portion, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said free end portion of said tube portion and the opposite end thereof terminating in a free end portion in the region of said cuirass whereby said gage indicates the pressure in said region, and means providing for the automatic releasable interconnection of the one end of said tube with said free end portion of said tube portion on the interconnection of said conduit with said pumping means.

5. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass, a casing for housing said pumping means having an instrument panel associated therewith, and a pressure indicating gage positioned on said instrument panel, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, said conduit terminating in fittings, said cuirass and said casing having fittings formed complementary to said conduit fittings, said casing fitting being in fluid communication with said pumping means, a tube portion in fluid flow relation with said gage and terminating in a free end portion in the region of said casing fitting, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said free end portion of said tube portion and the opposite end thereof terminating in a free end portion in the region of said cuirass fitting whereby said gage indicates the pressure in said region, and means providing for the automatic interconnection of the one end of said tube with said free end portion of said tube portion on the interconnection of said conduit and casing fittings.

6. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass a casing for housing said pumping means having an instrument panel associated therewith, and a pressure indicating gage positioned on said instrument panel, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, said conduit terminating in fittings, said cuirass and said casing having fittings formed complementary to said conduit fittings, said casing fitting being in fluid communication with said pumping means, a tube portion in fluid flow relation with said gage and terminating in a free end portion in the region of said casing fitting, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said free end portion of said tube portion and the opposite end thereof terminating in a free end portion in the region of said cuirass fitting whereby said gage indicates the pressure in said region, and means providing for the automatic releasable fluid sealing interconnection of the one end of said tube with said free end portion of said tube portion on the interconnection of said conduit and casing fittings.

7. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air

from a cuirass, a casing for housing said pumping means having an instrument panel associated therewith, and a pressure indicating gage positioned on said instrument panel, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, said conduit terminating in fittings, said cuirass and said casing having fittings formed complementary to said conduit fittings, said casing fitting being in fluid communication with said pumping means, a tube portion in fluid flow relation with said gage and terminating in a free end portion in the region of said casing fitting, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said free end portion of said tube portion and the opposite end thereof terminating in a free end portion in the region of said cuirass fitting whereby said gage indicates the pressure in said region, and means providing for the automatic interconnection of the one end of said tube with said free end portion of said tube portion on the interconnection of said conduit and casing fittings, said conduit fittings being structurally similar and said tube ends being structurally similar whereby said conduit fittings may be interchangeably connected to said casing fitting with said tube interconnected with said tube portion.

8. In respirator apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass, a casing for housing said pumping means having an instrument panel associated therewith, and a pressure indicating gage positioned on said instrument panel, a conduit connecting said pumping means to said cuirass in fluid flow relation therewith, said conduit terminating in fittings, said cuirass and said casing having fittings formed complementary to said conduit fittings, said casing fitting being in fluid communication with said pumping means, a tube portion in fluid flow relation with said gage and terminating in a free end portion in the region of said casing fitting, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said free end portion of said tube portion and the opposite end thereof terminating in a free end portion in the region of said cuirass fitting whereby said gage indicates the pressure in said region, and means providing for the automatic interconnection of the one end of said tube with said free end portion of said tube portion on the interconnection of said conduit and casing fittings, said means comprising complementary releasably interengaging fittings at said one end of said tube and at said free end portion of said tube portion.

9. In respirator apparatus, a longitudinally extending flexible conduit terminating in fittings adapted for the securement of said conduit to said apparatus, and a flexible pressure transmitting tube extending longitudinally in said conduit and terminating in fittings, one of said last mentioned fittings being adapted for the securement of said tube to complementary structure of said apparatus, said conduit fittings being structurally similar and said tube ends being structurally similar whereby said conduit fittings may be interchangeably connected to said apparatus with said tube interconnected with said complementary structure, and means for supporting end portions of said tube in said conduit in coaxial relation therewith.

10. In respirator pumping apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass, valve means for controlling the amount of positive pressure applied to said cuirass, said valve means comprising an axially movable diaphragm and a part associated therewith for limiting the axial movement of said diaphragm in one direction, said part being threadedly received in a complementary fixed part whereby the rotation of said part is effective to axially move the latter relative to said fixed part, said part having gear means associated therewith, for the rotation thereof and means for actuating said gear means for adjusting the axial position of said part.

11. In respirator pumping apparatus having pumping means adapted to periodically supply air to and withdraw air from a cuirass, valve means for controlling the amount of positive pressure applied to said cuirass, said valve means comprising an axially movable diaphragm and a part associated therewith for limiting the axial movement of said diaphragm in one direction, said part being threadedly received in a complementary fixed part whereby the rotation of said part is effective to axially move the latter relative to said fixed part, said part having gear means associated therewith, for the rotation thereof and means for actuating said gear means for adjusting the axial position of said part, said last mentioned means comprising a manually operable member having gear means in mesh with said first mentioned gear means for actuating the latter.

12. Respirator pumping apparatus adapted to periodically supply air to and withdraw air from a cuirass, comprising a pump having a fixed head and a movable piston defining a pumping chamber therebetween, a port in said fixed head in communication with said pumping chamber, and valve means for controlling the amount of positive pressure applied to said cuirass, said valve means controlling the venting of said port and comprising an axially movable diaphragm and a part associated therewith for limiting the axial movement of said diaphragm in a venting direction, said part being threadedly received in a complementary fixed part whereby the rotation of said part is effective to axially move the latter relative to said fixed part, said part having gear means associated therewith for the rotation thereof, and means for actuating said gear means for adjusting the axial position of said part whereby to control the venting of said port.

13. In combination with an air pump cyclically operable for inducing a rhythmic flow of air to and from a cuirass and a pressure indicating gage positioned remote from said cuirass, a conduit providing for the fluid flow interconnection of said air pump and said cuirass, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said gage and being in a fixed relative disposition to a companion end of said conduit, the opposite end of said tube terminating in a free end portion in the region of said cuirass whereby said gage provides for the direct indication of pressure in said region, and means providing for the automatic interconnection of the one end of said tube with said gage on the interconnection of said pump and conduit.

14. In combination with an air pump cyclically operable for inducing a rhythmic flow of air to and from a region remote from said pump and a pressure indicating gage positioned in close proximity to said pump, a conduit providing for the fluid flow interconnection of said pump with said region, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconnection with said gage and being in a fixed relative disposition to a companion end of said conduit, the opposite end of said tube terminating in a free end portion in said region whereby said gage provides for the direct indication of pressure in said region, and means providing for the automatic interconnection of the one end of said tube with said gage on the interconnection of said pump and conduit.

15. In combination with an air pump cyclically operable for inducing a rhythmic flow of air to and from a cuirass and a pressure indicating gage positioned remote from said cuirass, a conduit providing for the fluid flow interconnection of said air pump and said cuirass, and a tube extending longitudinally in said conduit, one end of said tube being adapted for interconection with said gage and being in a fixed relative disposition to a companion end of said conduit, the opposite end of said tube terminating in a free end portion in the region of said

cuirass whereby said gage provides for the direct indication of pressure in said region, and means providing for the automatic interconnection of the one end of said tube with said gage on the interconnection of said pump and conduit, said means comprising a length of tubing in fluid flow relation with said gage, said length of tubing and said one end of said tube terminating in releasably interengageable fittings.

16. In respirator apparatus, a longitudinally extending flexible conduit terminating in fittings adapted for the securement of said conduit to said apparatus, and a flexible pressure transmitting tube extending longitudinally in said conduit and terminating in fittings in the region of

the fittings of said conduit, one of said tube fittings being adapted for automatic releasable securement to complementary structure of said apparatus on the interconnection of a companion conduit fitting with said apparatus, and means for supporting said tube fittings in a fixed relative disposition with said conduit fittings.

References Cited in the file of this patent

UNITED STATES PATENTS

1,154,811	Savage	Sept. 28, 1915
2,408,136	Fox	Sept. 24, 1946
2,512,116	Siebels	June 20, 1950
2,581,893	Wilm	Jan. 8, 1952