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2,860,633

COMPOUND SWIVEL ADAPTOR AND COUPLING FOR ANESTHESIA

Filed Aug. 17, 1956

2 Sheets-Sheet 1

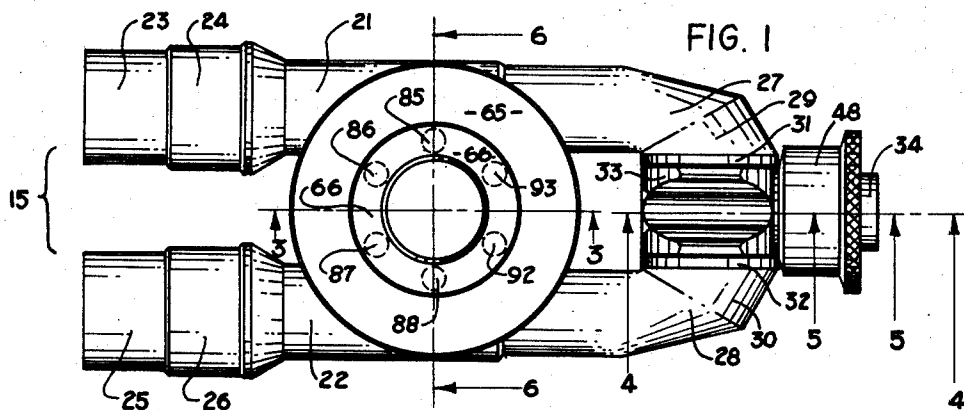


FIG. 2

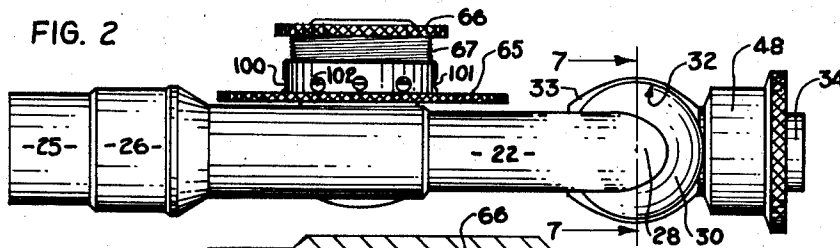


FIG. 3

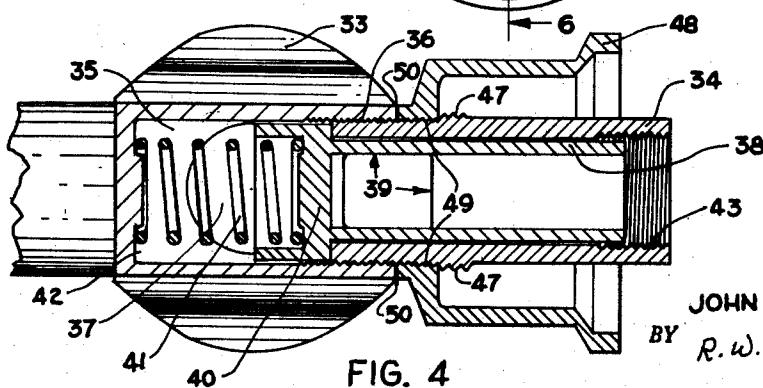
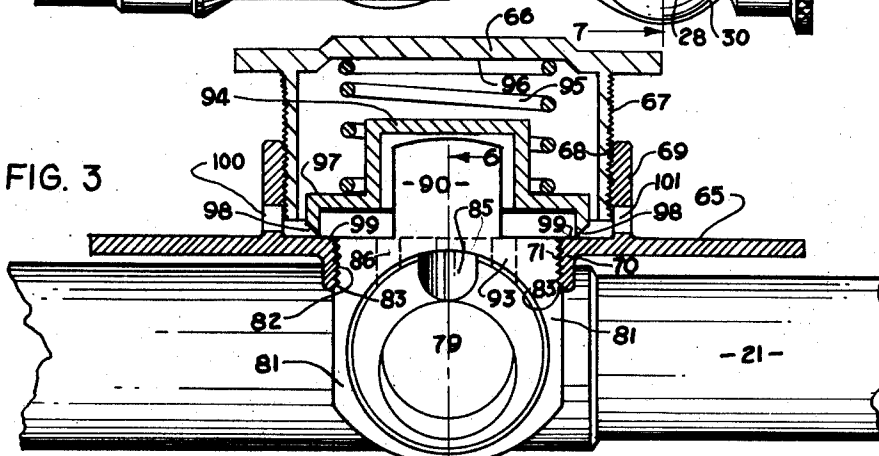


FIG. 4

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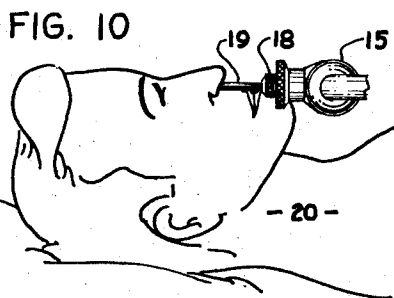
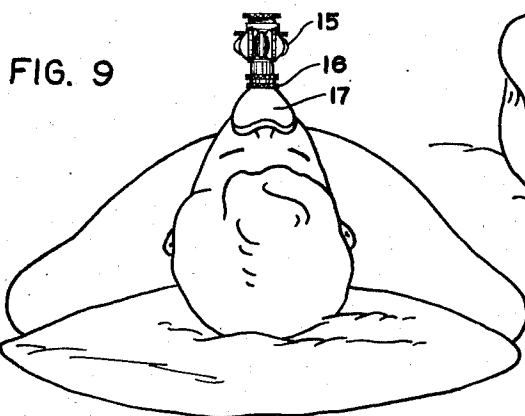
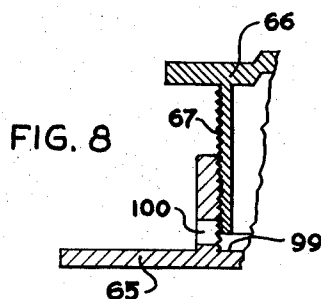
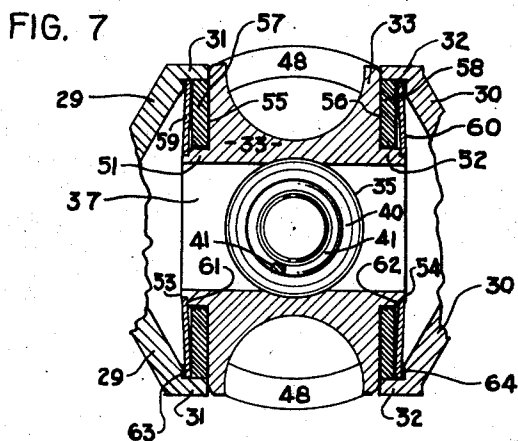
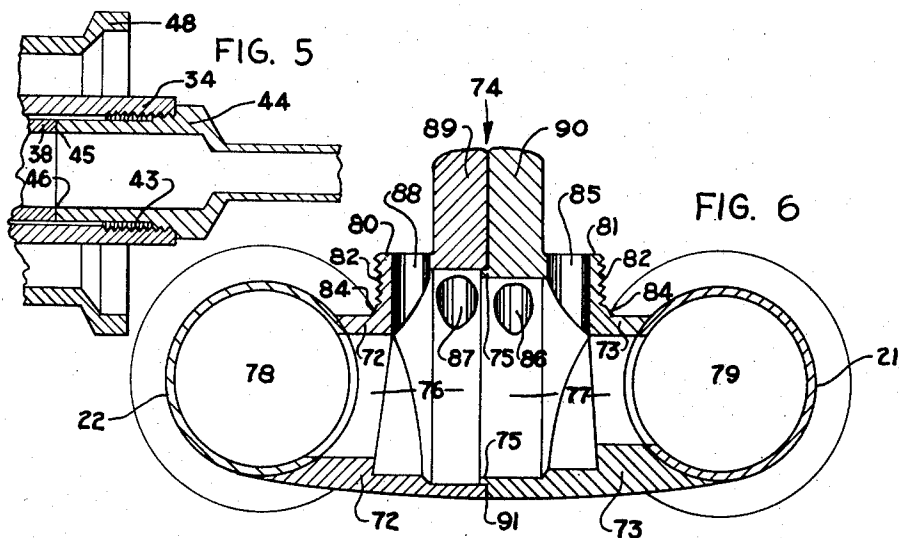
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COMPOUND SWIVEL ADAPTOR AND COUPLING FOR ANESTHESIA

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Application August 17, 1956, Serial No. 604,660

16 Claims. (Cl. 128—188)

This invention relates to equipment for administering anesthetics and, more particularly, to an applicator head assembly including a pressure relief valve and a compound swivel coupling for attaching the breather tubes of a circle absorption type of anesthetic machine to either a face mask or an endo-tracheal tube used in surgical anesthesia.

One of the major difficulties encountered by surgical anesthetists in the use of anesthesia equipment heretofore available to the profession, has been the proper positioning of the breather tubes communicating between the anesthetic machine and the patient. Even with the patient lying supine upon the operating table it is frequently necessary to use a large number of sizes of both straight and angular connectors depending upon the location of the operation to be performed and whether a face mask is employed or an endo-tracheal tube is inserted through the patient's mouth or nostril. Quite frequently it is found necessary to move the anesthesia machine itself into a variety of inconvenient and awkward positions relative to the table and the floor space adjacent thereto.

And in addition to the difficulties encountered in making the initial connections between the patient and the anesthesia machine, great difficulties of technique and hazards in emergencies frequently occur during the administration of the anesthetic when it is desired to move the patient or to discontinue the application of the anesthetic for a short period of time.

My invention has been made with the foregoing considerations in mind and can be said to have a plurality of important objectives.

One important object of my invention is the provision of a device adapted for connecting the breather tubes of an anesthesia machine to a face mask or tracheal tube and having a wide range of directional adjustability.

Another important object of my invention is the provision of a device of the character described which can be completely disassembled into individual parts for purposes of sterilizing.

A further important object of my invention is the provision of a device of the character described which when assembled is substantially airtight yet is readily movable in its jointed sections for purposes of adjustment.

A still further important object of my invention is the provision of a device of the character described which is provided with an obturator valve to automatically close the passage from the breather tubes upon disconnection of the face mask or tracheal tube therefrom.

An additional object of my invention is the provision of a device of the character described which is further provided with a combination by-pass and pressure relief valve which automatically offsets inordinate back pressure or the effect of improper adjustment of flowmeters in the breather system.

Certain variations of the embodiment and additional objects of the invention will become apparent in the following detailed specification when taken with reference to the accompanying drawings, in which:

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Figure 1 is a plan view of an applicator head constructed according to my invention;

Figure 2 is a side elevational view of the same assembly;

Figure 3 is a sectional view taken along the line and in the direction indicated by the arrows 3—3 in Figure 1;

Figure 4 is a similar sectional view taken along the line and in the direction indicated by the arrows 4—4 in Figure 1, showing the interior arrangement of the applicator socket;

Figure 5 is a view related to Figure 4 showing the positioning of the connector nipple in the socket seen in Figure 4;

Figure 6 is a cross sectional view taken along the lines 6—6 in Figure 1 and shown in section in Figure 3;

Figure 7 is a cross sectional view of the socket rotor assembly taken along the line and in the direction of the arrows 7—7 in Figure 2;

Figure 8 is a fragmentary sectional view taken from Figure 3 showing more clearly certain details of the relief valve cover;

Figure 9 is a diagrammatic view of the device of my invention being used to administer an anesthetic with a face mask, and

Figure 10 is a similar view from one side showing the applicator head being used with a tracheal tube for the administration of an anesthetic.

Reference is again made to Figure 1 which shows in plan view an anesthetic applicator head constructed according to my invention, and attention is also directed to Figures 9 and 10 which show typical techniques employed in the use of devices of this character. Figure 9 presents an end view of the applicator which is designated generally by the numeral 15, showing it engaged with a connector nipple 16 communicating with a face mask 17, and in Figure 10 the device 15 is shown to connect with a tubular nipple 18 and a tracheal tube 19 entered in a nostril of the patient 20.

Again in Figure 1 the device of my invention is seen to include a pair of longitudinally extended tubular assemblies 21 and 22 having tapered sleeves of two diameters as seen at 23 and 24 and at 25 and 26 adapted to interfit with the breather system tubing communicating with an anesthesia machine. The two diameters, as at 23 and 24, are provided in order to accommodate either of two frequently used tubing sizes.

At their ends spaced from the sleeve sections, the tube assemblies 21 and 22 are seen to turn inwardly in opposite symmetrical elbow sections 27 and 28 which are flared outwardly in the angular sections 29 and 30 and are terminated in circular flanged openings disposed in parallel spaced planes as seen at 31 and 32. A generally cylindrical socket rotor section 33 is seen in Figure 1 rotatably disposed between the flanged openings 31 and 32 of the tubes 21, and 22, and the manner in which they are interfitted and articulated therein will be described in detail hereinafter.

A sleeve-like socket member 34, also seen in Figure 2, and shown in longitudinal section in Figure 4, is threadedly engaged in the opening of a recess 35 bored diametrically into the cylindrical section 33 as seen at 36.

As can also be seen in Figure 4, the recess 35 intersects an axial bore 37 which communicates between the flanged apertures 31 and 32 with the passages within the tube assemblies 21 and 22. A tubular plunger member 38 having apertures in the sidewall thereof as seen at 39 is provided with a cup-shaped top section 40 and is longitudinally slidable within the tubular socket 34 and is urged inwardly thereof by the coil spring 41 disposed between the top 40 and the inner termination of the recess 35 as seen at 42.

As will be understood, when the plunger 38 is in the

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position shown in Figure 4, gases within the bore 37 and the chamber 35 are prevented from passing through the aperture 39 into the passages within the plunger 38 and the socket sleeve 34, and thence to the mask or tracheal tube. However, when a connector nipple such as is seen at 44 in the fragmentary view of Figure 5 is inserted into the threaded section 43 of the sleeve 34, its inner end 45 engages the outward end 46 of the plunger 38 thereby forcing the plunger 38 outwardly of the sleeve 34 so that gas and fluid pressure is admitted through the aperture 39, and thence, as previously indicated, to the patient as shown in Figure 10.

In this manner the plunger 38 is seen to be effective as an obturator valve which automatically stops the flow of gas from the passage 37 into the socket sleeve 34 when a connector nipple is removed from the internal threads 43 of the socket sleeve 34.

Also shown in Figure 4 is a cup-shaped collar member 48 which is internally threaded as seen at 49 and engageable with the thread 36 of the socket sleeve 34, and which is tight in rigid abutment against the threaded larger diameter of 34 at 47. Sleeve 34 is free to rotate in its threaded relation to rotor 33 at 36. The large number of threads per longitudinal distance at this point provides an effective seal against gas leakage.

It should also be noted that a female connector (such as is indicated at 16 in Fig. 9) which is adapted to connect the socket 34 with respect to an anesthesia face mask (such as is indicated at 17 in Fig. 9) may be employed in place of the male nipple connector 44 shown in Fig. 5 (such as is indicated at 18 in Fig. 10 for connection to an oro-tracheal tube 19 shown in said Fig. 10). In this female face mask connector version (such as is shown in Fig. 9) a hollow sleeve, interiorly threaded at its front end, is adapted to slip over the socket sleeve 34 (see Figs. 4 and 5) to the rear end thereof and to threadedly engage the exterior large coarse threads 47 (best seen in Fig. 4) and said tube is adapted to simultaneously insert into the interior of the socket sleeve 34 a non-threaded tubular member very much like the member 44 shown in Fig. 5 and similarly adapted to abut the end 46 of the plunger 38 for opening the obturator valve in a manner functionally similar to the operation of the structure shown in Fig. 5, and comprising merely a change of the threading position from an exteriorly threaded male nipple structure to an interiorly threaded female nipple structure. This is thought to be completely clear and to require no further explanation.

The manner in which the cylindrical socket rotor 33 is rotatably journaled between the end flanges 31 and 32 of the tubes 21 and 22 is readily understood by reference to Figure 7 which is a vertical section taken along the axis of the rotor 33 as it would appear along the line and in the direction indicated by the arrows 7—7 in Figure 2. The flared sections 29 and 30 of the tubes 21 and 22 are fragmentarily shown in the figure, and the conformation of their flanged ends 31 and 32 including their inner bearing surfaces 63 and 64, is clearly illustrated.

Outwardly extended at each end of the axial bore 37 of the rotor section 33, are circular hub portions 51 and 52 terminated in sections 53 and 54 of diminished diameter, thus providing circular offsets 55 and 56 adapted to receive the flat washers 57 and 58 therein and outwardly of the washers the flat shim members 59 and 60 bear interiorly against the offsets 61 and 62 provided by the hub sections of reduced diameter 53 and 54. It should be clearly noted that the washers 57 and 58, in the preferred form illustrated in Fig. 7, are press-fitted into the corresponding flanged portions 31 and 32 of the two tubes 21 and 22, respectively, whereby said tubes 21 and 22, when separated from the central rotor section 33, also separate said washers 57 and 58 and the corresponding shims 59 and 60 from the hub portions of the rotor section 33.

As can be seen by reference to the figure, the hub ex-

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tensions 51 and 52 are deeper than the thickness of the washers 55 and 56, and the shoulders 61 and 62 of the hub extensions 53 and 54 are more widely spaced than the bearing surfaces 63 and 64 in the flanges 31 and 32 against which the shims are positioned adjacent their outer circumferential edges. Thus the shims are urged out of flat planar alignment and are constantly under shear tension, causing them to bear tightly against the inner surfaces 63 and 64 of the flanged sections and against the shoulders 61 and 62 of the hub extensions. In general, the large washers carry the thrusts involved in the jointure and the shims serve as seals to prevent escapement of gas or fluid pressure therefrom.

Reference is again made to the plan view of Figure 1 and the related side elevational view of Figure 2 in which the exterior of the by-pass relief valve portion of the applicator head of my invention is seen to include a flanged internally threaded binding ring clamp 65 and a central cap member 66 which is threaded at 67 to engage the threads 68, better seen in Figure 3, disposed interiorly of a collar section 69 extended upwardly from the ring 65. The ring clamp 65 is also provided with an oppositely extended collar 70 of smaller diameter and being internally threaded as seen at 71.

More specific reference is now made to Figure 3 which is a longitudinal section taken along the line and in the direction indicated by the arrows 3—3 in Figure 1, and to the cross sectional view of Figure 6 which is taken along the line and in the direction indicated by the arrows 6—6 in Figure 1. As is most clearly shown in Figure 6, a pair of boss sections 72 and 73 are extended inwardly from facing sides of the main tube members 21 and 22 respectively, and their inwardly extended faces come together along a plane intermediate of the tubes indicated by the arrow 74. The plane of abutment 74 is broken only by an internal circular flange 75 extended outwardly from the boss 73 and adapted to interfit with the the opposing aperture of the boss 72.

As shown in Figure 6 the bosses 72 and 73 are interiorly chambered as seen at 76 and 77 and communicate interiorly with the passages 78 and 79.

Adjacent the plane of abutment 74, the boss sections are extended in semicylindrical sections as indicated at 80 and 81 which combine to form a cylindrical section which is threaded circumferentially as seen at 82 to interfit with the threads 71 disposed interiorly of the collar portion 70 of the ring clamp 65, as indicated in Figure 3. When the collar portion 70 is bottomed on the thread 82, the inwardly bevelled edge 83 of the collar 70 is forced into circumferential angular contact with the angular termination 84 of the threads 82, and is thereby effective to force the boss members 72 and 73 into tight juxtaposition along their mutual plane of abutment 74.

A plurality of bores such as 85, 86, 87 and 88 extend from the inner chambers 76 and 77 of the bosses 72 and 73 through the extensions 80 and 81, and are disposed radially around the terminal extensions 89 and 90 which are provided to keep the bosses from drawing apart at their bottom point of contact 91 and to assure the tight alignment of the boss surfaces throughout the entire plane 74 when the ring clamp collar 70 is tightened against the angular surface 84.

Other openings from the chambers 76 and 77 through the extensions 80 and 81 are indicated at 92 and 93 in Figure 1 and at 93 in Figure 3.

A cap member 94, which is visible only in Figure 3, is disposed over the upper ends of the terminal extensions 90 in Figure 3 and 89 and 90 in Figure 6, and is forced downwardly by the spring 95 disposed between the undersurface 96 of the outer cap 66 and the offset 97 of the cap 94 and into contact along the point of its sharp rim 98 with the upwardly disposed inner surface 99 of the binding ring 65.

The pressure relief valve is effectively provided with damping or filtering means adapted to damp or filter

out pressure pulsations and oscillatory movement or chatter of the cup-shaped valve cap. In the specific example illustrated (as best seen in Figures 2 and 3), this damping means comprises the chamber around the cap 94 effectively provided by the outer cap 66 and the engagement of the threaded downwardly extending portion thereof 67 with the threaded upwardly extended collar portion 69 of the binding ring 65, and the provision of a plurality of restricted outlet orifice means, which in the specific example illustrated, take the form of a plurality of radial orifices or bores disposed through the collar portion 69 of the binding ring 65, as shown at 100, 101, 102, etc. The resistance to outflow caused by these restricted outlet orifices is so correlated with respect to the tension of the spring 95, and the moving masses involved, as to effectively damp or filter out oscillatory movement of the cap 94 and corresponding pressure pulsations—in other words, the structure provides what may be described as a gaseous or pneumatic type filter coupled to the output of a pressure relief valve.

It should also be noted that any sudden increase in back pressure, such as might occur in the breather system of the anesthesia machine from a sudden or deep exhalation of a patient, would cause the cap 94 to move upwardly against the tension of the spring 95, thus raising the sharp annular rim 98 of the cup-shaped valve cap 94 from the seating surface 99 of the binding ring 65, and thus relieving the excess fluid pressure through the restricted outlet orifices 100, 101, 102, etc.

It should also be noted that the cap 66 may be threadedly moved vertically with respect to the threaded collar 69 whereby to effectively adjust the total combined effective cross-sectional area of the restricted outlet orifices 100, 101, 102, etc., while at the same time correspondingly adjusting the tension of the biasing spring 95 in a correlated manner such as to maintain the above-mentioned damping and/or filtering action, or in a manner such as to adjust said damping or filtering action in a desired way.

It should also be noted that, if desired, the cap 66 may be screwed down tightly to effectively completely close the valve by threadedly downwardly advancing the cap 66 until it bottoms or seats against the upper surface 99 of the ring clamp 65, thereby closing the apertures 100, 101, 102, etc.

Incidentally, Fig. 8 illustrates a slight modification of the aperture closing feature just described in the preceding paragraph—this modification having the threads on the interior of the collar 69 extending clear to the bottom of said collar immediately above the surface 99.

As has been previously explained, one of the main prerequisites of a surgical accessory of this character is that it be quickly disassemblable by manual means for purposes of cleaning, and this requirement is completely fulfilled in the device of my invention.

Disassembly of the device is quickly accomplished by unthreading the ring clamp 65 from the cylindrical extensions 81 and 82 of the boss sections 72 and 73. This permits the tubes 21 and 22 to separate along the abutment line 74 thereby also separating the flanged ends 31 and 32 from the cylindrical rotor 33 and removing the shim members 59 and 60 and the washers 57 and 58 (which are press-fitted into the flanges 31 and 32) from the hub extensions 53 and 54 and 51 and 52 respectively. The socket sleeve 34 is then unthreaded from the recess 35 and the collar 48, thus also releasing the plunger member 38 and the coil spring 41. Finally the upper cap 66 is unthreaded from within the collar 69 of the ring clamp 65, thus releasing the cap 94 and its tension spring 95.

Numerous modifications and variations of the present invention will occur to those skilled in the art after a careful study hereof. All such, properly within the basic spirit and scope of the present invention are intended to

be included and comprehended herein as fully as if specifically described, illustrated and claimed herein.

The exact compositions, configurations, constructions, relative positionings, and cooperative relationships of the various component parts of the present invention are not critical, and can be modified substantially within the spirit of the present invention.

The embodiments of the present invention specifically described and illustrated herein are exemplary only, and are not intended to limit the scope of the present invention, which is to be interpreted in the light of the prior art and the appended claims only, with due consideration for the doctrine of equivalents.

I claim:

1. A fluid pressure applicator head providing means for connecting a face mask or tracheal tube to the breather system of an anesthesia machine, and means for controlling the fluid pressure therein, comprising: a pair of symmetrical tube members being oppositely disposed in parallel spaced relationship, said tubes having nipples at one end adapted to interfit with breather system tubing, and having elbow sections with facing spaced apertures at their other ends; socket means journaled interiorly of said spaced apertures and rotatable therebetween, said socket means being adapted to receive rotatably therein the nipple communicating with a face mask or tracheal tube; transverse duct means communicating interiorly with both of said tubes and disposed intermediate of the ends thereof, and valve means opening from said duct being adapted to open and relieve pressure within said duct at a predetermined limit.

2. The invention in accordance with claim 1 being further characterized by said socket means having therein a spring tensioned obturator valve adapted to close when a nipple communicating with a facial mask or tracheal tube is removed therefrom.

3. The invention in accordance with claim 2 in which said socket means comprises: a generally cylindrical body portion having an axial bore therethrough and a lateral bore opening outwardly from said axial bore; said lateral bore being interiorly threaded to receive an externally threaded sleeve member therein; said sleeve being threaded to receive a connector nipple therein, and a flanged member fastened to said sleeve and threadedly movable therewith with respect to said interiorly threaded lateral bore, providing a leak-proof manually operable rotary connection between said bore and said sleeve.

4. The invention in accordance with claim 3 being further characterized by said cylindrical section having extended from each end thereof around said axial bore therethrough a first hub portion of one diameter and a second hub portion of diminished diameter; a flat washer member disposed on each of said first hub portions, and a thin shim member being disposed on each of said second hub portions; said shim members and washer members being mounted circumferentially within said facing spaced apertures of said elbow sections of said tube members.

5. The invention in accordance with claim 4 in which said second hub portions of diminished diameter are spaced, axially of said cylindrical body portion, farther apart than the mounting of said washer members within said facing spaced apertures of said elbow sections of said tube members.

6. A device for connecting the breather tubes of an anesthesia machine to a face mask or tracheal tube, comprising: a pair of generally symmetrical tube assemblies having sleeve portions at one end adapted to interfit with the tubes communicating with an anesthesia machine, in bent flanged apertures at the other end, and hollow boss sections oppositely extended from and communicating interiorly of said tubes intermediate of said ends; said bosses being adapted to abut between said tubes and being threadedly engageable with clamp means adapted to hold them in tight abutment; said hollow boss sections

being provided with aperture means interiorly of said clamp means, and pressure sensitive valve means associated with said clamp being movably disposed over said aperture means and adapted to open at a predetermined limit of pressure within said bosses; socket means rotatably disposed between said flanges of said inbent ends of said tubes, and communicating interiorly with said tubes; said socket means being adapted to receive connector nipples communicating with conventional face masks and tracheal tubes, and means for swivelling said nipples therein.

7. Apparatus of the character defined in claim 6 wherein said pressure sensitive valve means comprises: a cup-shaped valve member having a downwardly directed sharp sealing rim and seat means engageable therewith in a manner sealingly enclosing said aperture means, said valve member having a greater area exposed to pressure from said aperture means than the effective area of said aperture means; chamber means enclosing said valve means and provided with restricted outlet orifice means connecting the interior and exterior of said chamber means; biasing spring means normally biasing said valve member into closed position; adjusting means cooperable with said restricted outlet aperture means for adjustably varying the total effective area thereof and simultaneously correlately adjusting the spring tension of the biasing spring means whereby to provide an effective damping and filtering means operable to filter and damp pressure pulsations and oscillatory movement of said valve member.

8. The invention in accordance with claim 7 being further characterized by said socket means having therein a spring tensioned obturator valve adapted to close when a nipple communicating interchangeably with a facial mask or tracheal tube is removed therefrom.

9. The invention in accordance with claim 8 in which said socket means comprises: a generally cylindrical body portion having an axial bore therethrough and a lateral bore opening outwardly from said axial bore; said lateral bore being interiorly threaded to receive an externally threaded sleeve member therein; said sleeve being threaded to receive a connector nipple therein, and a flanged member fastened to said sleeve and threadably movable therewith with respect to said interiorly threaded lateral bore, providing a leak-proof manually operable rotary connection between said bore and said sleeve.

10. The invention in accordance with claim 9 being further characterized by said cylindrical section having extended from each end thereof around said axial bore therethrough a first hub portion of one diameter and a second hub portion of diminished diameter; a flat washer member disposed on each of said first hub portions, and a thin shim member being disposed on each of said second hub portions; said shim members and washer members being mounted circumferentially within said flanges of said inbent ends of said tube assemblies.

11. The invention in accordance with claim 10 in which said second hub portions of diminished diameter are spaced, axially of said cylindrical body portion, farther apart than the washer members in said flanges.

12. Apparatus of the character defined in claim 6 in which said clamp means comprises: a flat washer-like ring having a generally cylindrical internally threaded collar

portion extended from the top and bottom surfaces thereof; the upper of said collar portions being provided with a plurality of circumferentially spaced restricted outlet orifice means; and the lower of said collar portions being terminated in an inwardly bevelled conical edge; and wherein said pressure sensitive valve means comprises: a cup-shaped valve member having a downwardly directed sharp sealing rim and seat means positioned thereunder and engageable therewith in a manner sealingly enclosing said aperture means, said valve member having a greater area exposed to pressure from said aperture means than the effective area of said aperture means; chamber means partially defined by said upper collar portion having said plurality of restricted outlet orifice means therein, said chamber means enclosing said valve means; biasing spring means normally biasing said valve member into closed position; an adjusting cap member having a closed top with the undersurface there abutting said biasing spring and forcing it downwardly against said valve member, said cap member having a cylindrical downwardly directed externally threaded sidewall section engageable within said internal threads of said upper collar portion of said cap member and cooperable to effectively vary the total cross-sectional area of the restricted outlet orifice means circumferentially spaced around said upper collar portion when threadably moved lineally with respect thereto, and also cooperable to effectively cause the airtight sealing of the valve when threadably advanced into sealing abutment with the surface of said clamp.

13. The invention in accordance with claim 12 being further characterized by said socket means having therein a spring tensioned obturator valve adapted to close when a nipple communicating interchangeably with a facial mask or tracheal tube is removed therefrom.

14. The invention in accordance with claim 13 in which said socket means comprises: a generally cylindrical body portion having an axial bore therethrough and a lateral bore opening outwardly from said axial bore; said lateral bore being interiorly threaded to receive an externally threaded sleeve member therein; said sleeve being threaded to receive a connector nipple therein, and a flanged member fastened to said sleeve and threadably movable therewith with respect to said interiorly threaded lateral bore, providing a leak-proof manually operable rotary connection between said bore and said sleeve.

15. The invention in accordance with claim 14 being further characterized by said cylindrical section having extended from each end thereof around said axial bore therethrough a first hub portion of one diameter and a second hub portion of diminished diameter; a flat washer member disposed on each of said first hub portions, and a thin shim member being disposed on each of said second hub portions; said shim members and washer members being fixedly mounted circumferentially within said flanges of said inbent ends of said tube assemblies.

16. The invention in accordance with claim 15 in which said second hub portions of diminished diameter are spaced, axially of said cylindrical body portion, farther apart than the washer members in said flanges.

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