

[54] ANAESTHESIA MACHINES

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[51] Int. Cl. **A61m 16/00**

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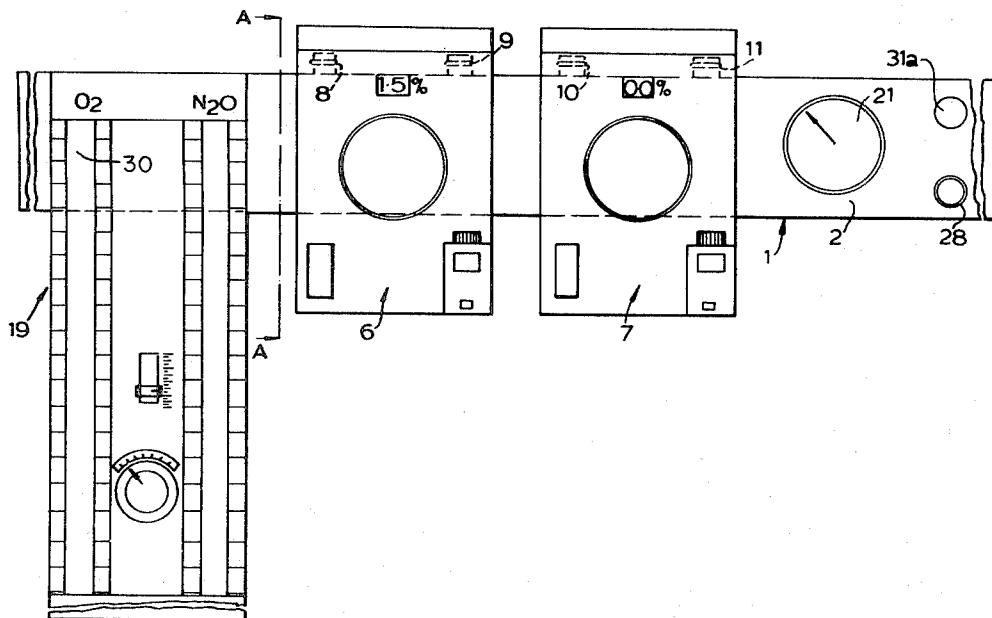
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[57]

ABSTRACT

A console rack for anaesthesia equipment, the rack having apparatus whereby an anesthesia unit can be plugged into position by access from the front of the rack and held in that position. The plug apparatus may be plug or socket elements for receiving mating connecting elements on an anaesthesia unit and may be appropriately interconnected by fluid circuit pipework built into the rear of the console rack. Bays on the rack for receiving anaesthesia units, and anaesthesia units for fitting in these bays may be designed on the modular principle.

13 Claims, 7 Drawing Figures



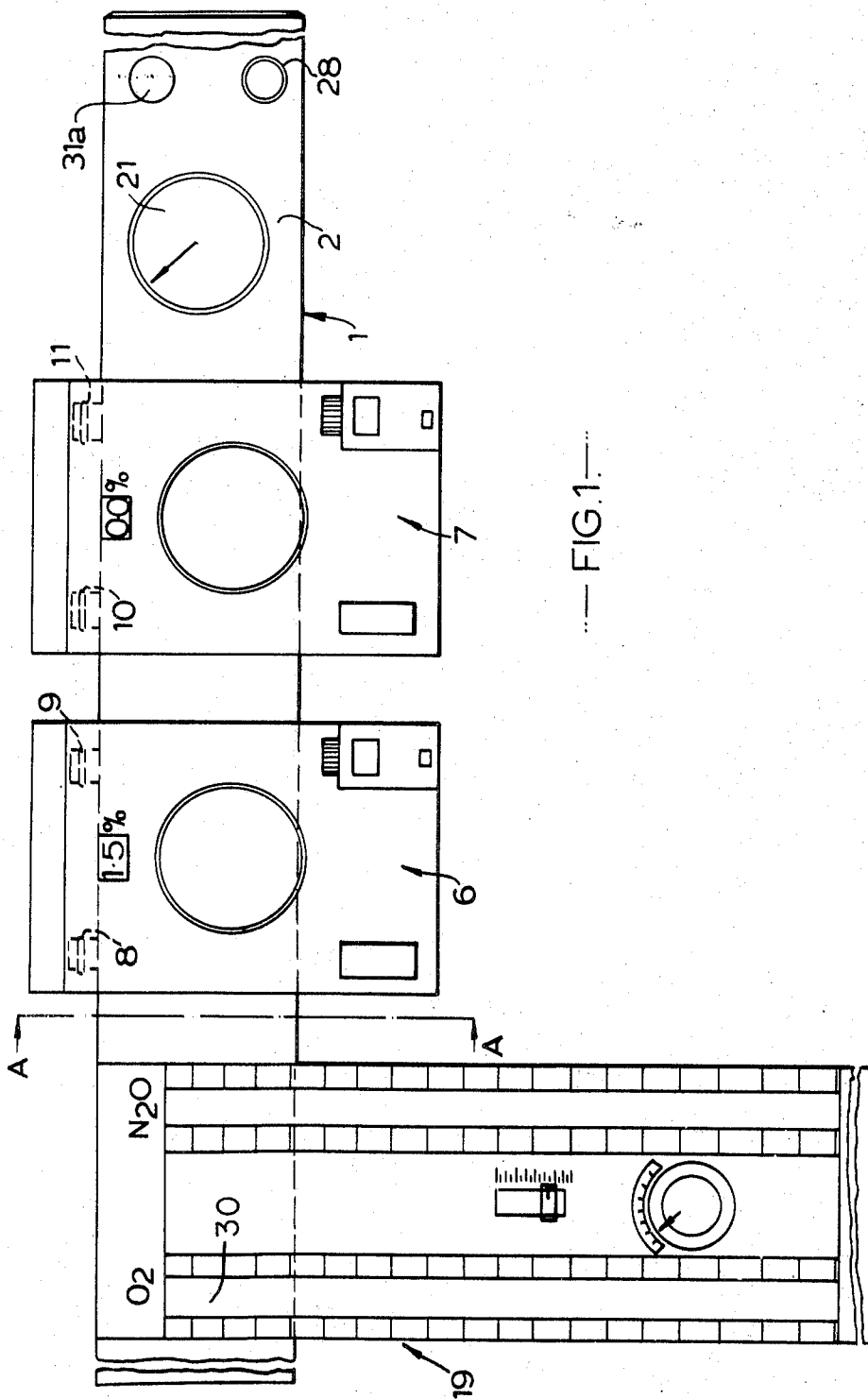
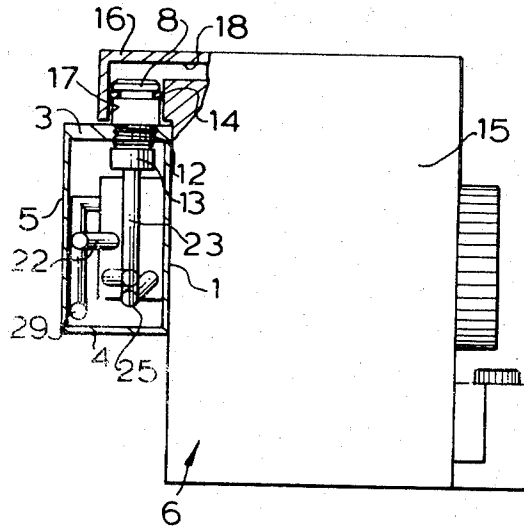
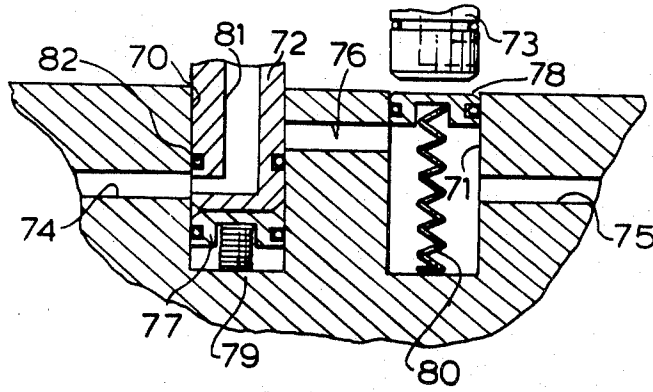


FIG. 1

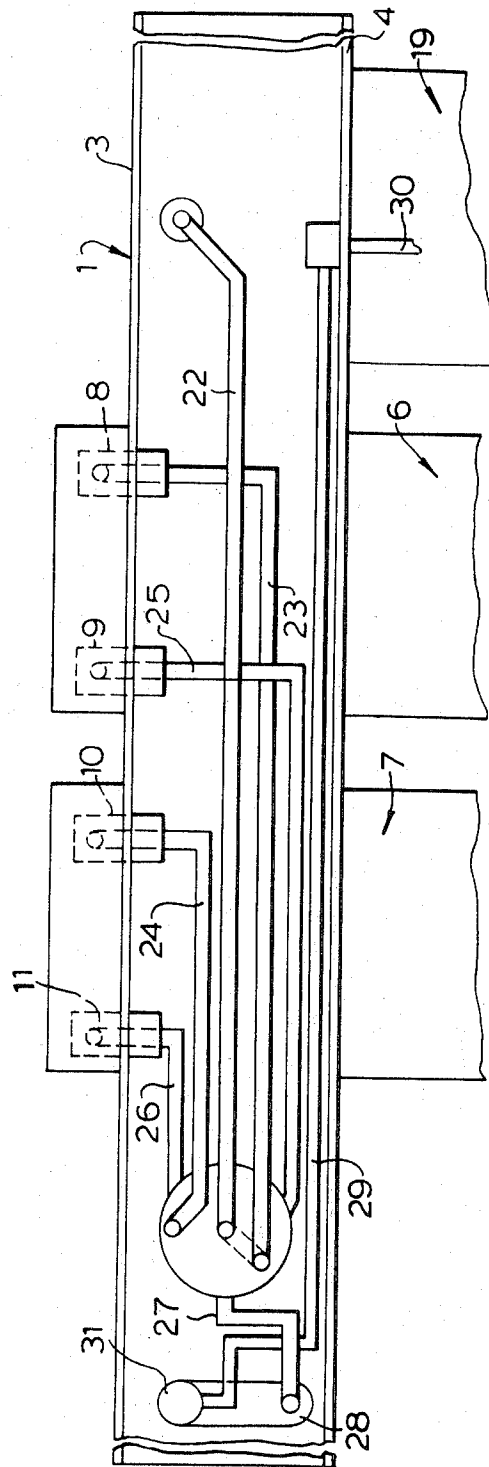


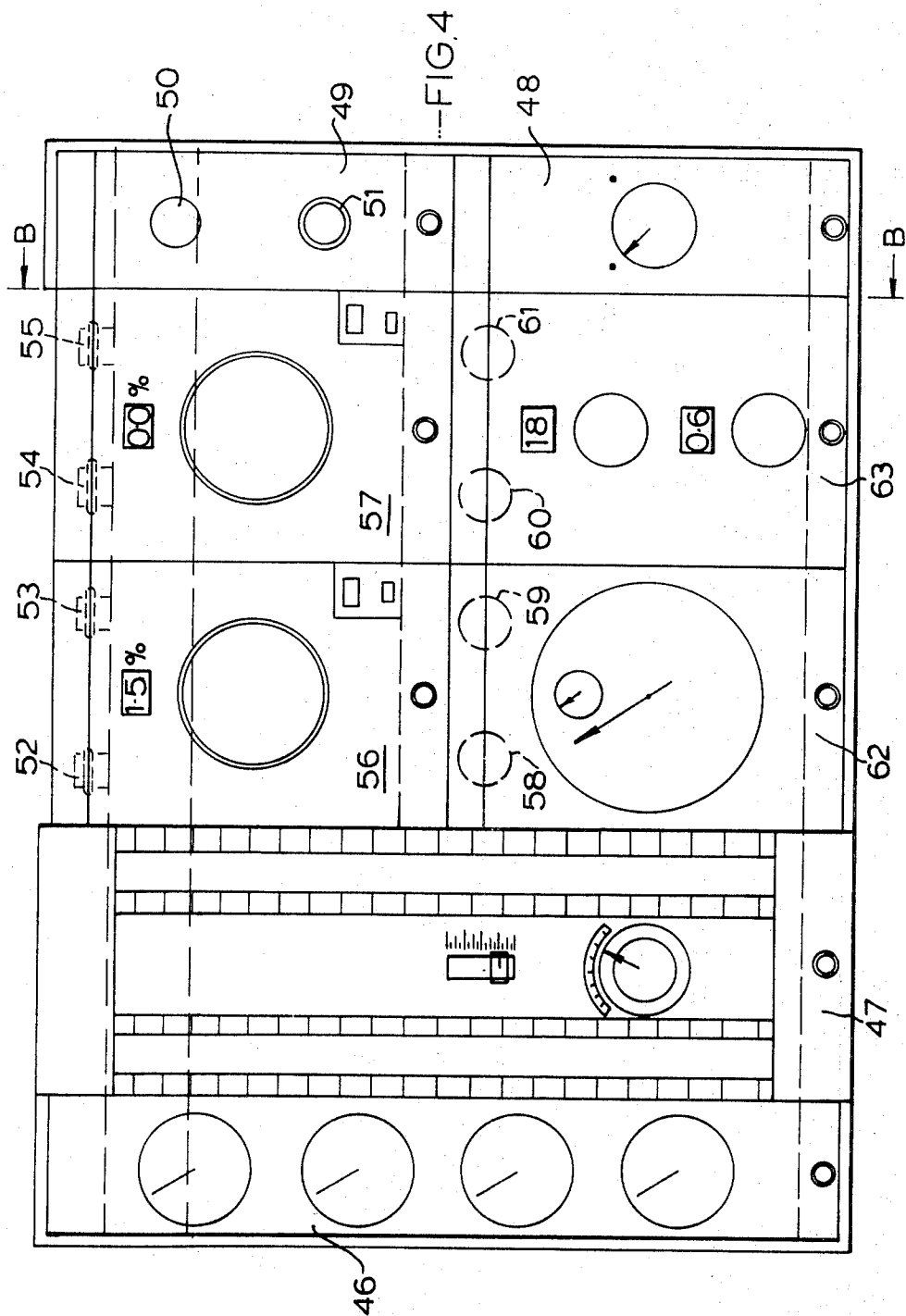
—FIG. 2.—

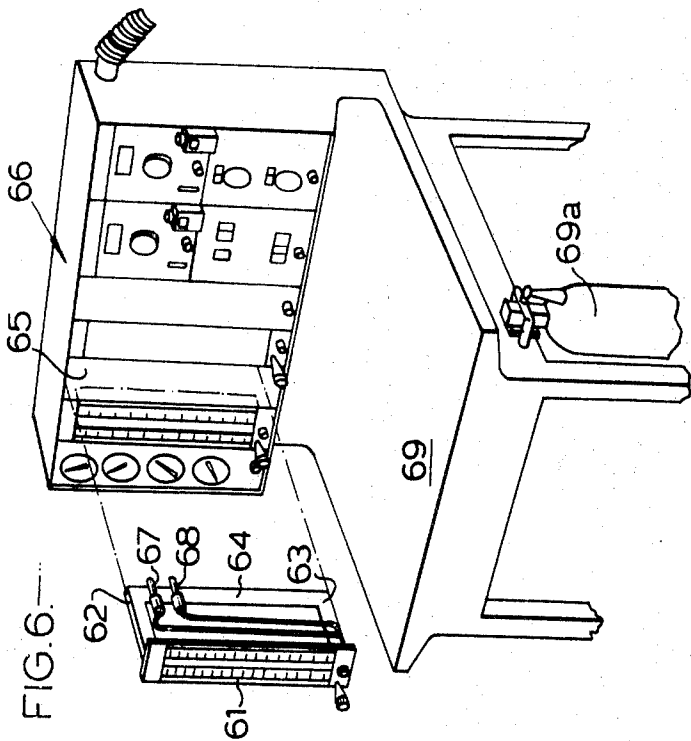
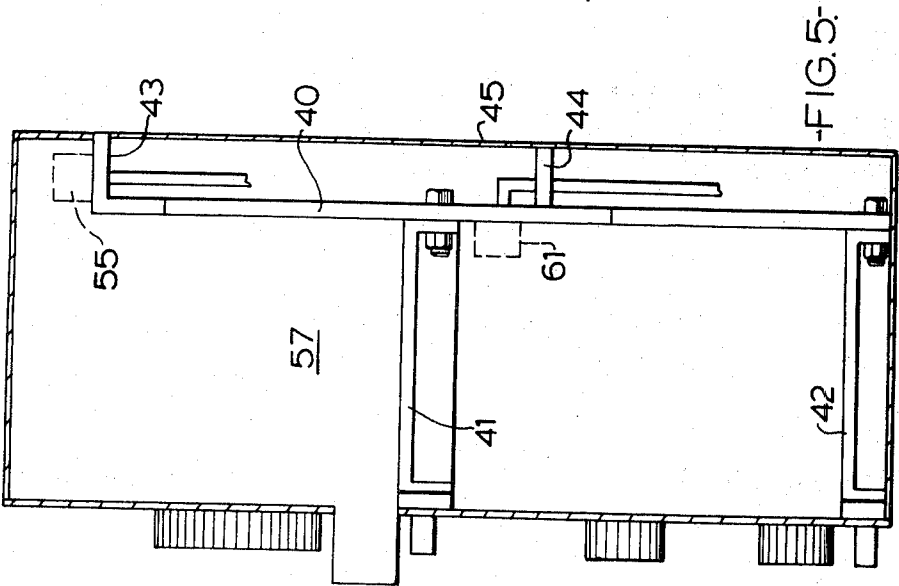


—FIG. 7.—

FIG. 3







ANAESTHESIA MACHINES

This invention relates to anaesthesia machines. Machines at present in use incorporate a back-bar to which the various anaesthesia units, such as flowmeters and vaporizers, are secured. Fluid connections between the various units are made by mating sockets and spigots aligned to give a flow path which is generally parallel to the back-bar. The seals obtained between the sockets and spigots are often not very satisfactory. Installation and removal of these units is a time-consuming and cumbersome operation. Apart from routine maintenance difficulties this can cause dangers if any unit should fail while the machine is in use during an operation. The failed unit can not be replaced rapidly and it is necessary to replace the entire machine with a standby machine which may be more or less ready for use. Further difficulty arises in operations wherein cauterization is necessary after the use of an explosive anaesthetic, such as ether.

According to the present invention there is provided a console rack for anaesthesia equipment, the rack having means whereby an anaesthesia unit can be plugged into position by access from the front of the rack and held in that position.

A plug-in system of this nature simplifies the installation and removal of units from the machine, so facilitating maintenance. Replacement of a single unit if this should fail during an operation can easily be made, and there is no need to use a standby machine. When cauterizing after using an explosive anaesthetic the vaporizer that contained the anaesthetic can be removed from the machine and taken outside the operating theatre before cauterization commences, so removing any danger of explosion.

The rack preferably has plug or socket elements for receiving mating connection elements on an anaesthesia unit, and the axes of at least some of these elements may lie perpendicular to the plane of the rack or may lie in or parallel to the plane of the rack. In a particularly advantageous arrangement the rack has a front face and a top face perpendicular to the front face, the top face being provided with plug or socket elements having axes perpendicular to the top face, and the front face being provided with plug or socket elements having axes perpendicular to the front face.

Appropriate ones of the plug or socket elements may desirably be interconnected by fluid circuit pipework built into the rear of the console rack. This built-in construction is of course highly advantageous although it is possible to use loose flexible piping for the connections between the various units, such piping either being direct between two units or between two sockets of the rack, to which sockets the units are connected.

Preferably the sockets in each bay are self-sealing to prevent fluid escaping when no unit is in place in that bay. Where the bay is provided with inlet and outlet sockets the valving may be of such a nature that when a unit is not present a fluid by-pass connection is made across the inlet and outlet sockets, and when a unit is present fluid may flow from the outlet and to the inlet. Continuity of the fluid circuit through a bay is thus maintained even if there is no unit in that bay.

Continuity may alternatively be achieved by the use of a connection block to connect the inlet and outlet sockets.

The console rack may comprise a number of defined bays, and as it may be undesirable to have certain anaesthesia units positioned in certain bays of the console, some or all bays may therefore be provided with indexing means co-operating with indexing means on the units to ensure that only a particular type of unit may be mounted in a particular bay. The indexing means may simply be different bay sizes, or the plugs or sockets provided in the bays may be indexed so that they will receive only a particular style of connector with which a unit is provided. Preferably, however, the indexing means are separate from the plug or socket elements.

Some or all of the bays may be designed on the modular principle to receive anaesthesia units constructed to a standard measure of length or width or both. Some or all of the bays of the console are conveniently provided with at least two sockets for connection to fluid-carrying lines. Some or all of the bays may also be provided with electrical plugs or sockets for making electrical connection to units in those bays.

In order that the invention may be better understood specific embodiments thereof will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a schematic front elevation of a first form of rack with anaesthesia units thereon;

FIG. 2 is a view, partly in section, taken on the line A—A of FIG. 1;

FIG. 3 is a schematic rear elevation of the rack of FIG. 1, with a cover plate removed;

FIG. 4 is a schematic front elevation of a second form of rack with units fitted thereto;

FIG. 5 is a view taken on the line B—B of FIG. 4;

FIG. 6 is a schematic perspective view of a third form of rack; and

FIG. 7 is a section through a valved socket assembly.

FIGS. 1 to 3 show a simple form of the invention wherein a console rack takes the form of a bar 1 of U-shaped cross section and having a front face 2, a top face 3 and a bottom face 4. The open rear face of the bar is closed by a removable cover plate 5. The ends of the top and bottom faces are formed with holes for receiving bolts by way of which the bar may be mounted on an anaesthesia machine, floor stand, wall bracket, ceiling bracket, arm from an operating table or other form of support.

The bar is designed to receive and support two plug-on anaesthetic vaporizers 6 and 7, each designed for use with a different anaesthetic. To this end the top face 3 of the bar is formed with a first pair of inlet and outlet spigots 8 and 9 for the vaporizer 6, and with a second pair of inlet and outlet spigots 10 and 11 for the vaporizer 7. Each spigot has a stem 12 (FIG. 2) threaded into a tapped bore in the top web of the bar and having means at its lower end to which a fluid pipe connector 13 can be secured. Each spigot carries an O-ring seal 14. Each of the vaporizers 6 and 7 comprises a body 15 having a rearwardly projecting upper flange 16 formed with two sockets such as 17 which fit over the respective inlet and outlet spigots, the O-ring seal 14 ensuring that the resulting connection is fluid-tight. The sockets connect by way of bores such as 18 with the interior of the vaporizer, which may be of conventional internal construction.

Bolted to the front face 2 of the bar in a conventional manner is a mixer unit 19 designed to receive gases (for examples oxygen and nitrous oxide) from gas supply lines connected to the mixer unit. The mixer unit may be of any design which will allow control of total output gas flow and of the proportions of different gases in the output flow. Mounted within the bar is a selector valve 20 having a control knob 21 exposed on the front face 2. The selector valve has two banks of valve connections operated in tandem by the control knob and may be of any suitable construction.

The output from the mixer unit 19 is connected to the input of a first bank of valve connections by a conduit 22, and two separate outlet connections of that bank are connected by conduits 23, 24 to the input spigots 8, 10 respectively for vaporizers 6 and 7. The output spigots 9, 11 respectively are connected by conduits 25, 26 to two separate inlet connections of a second bank of the valve, and the outlet connection from that bank is connected by a conduit 27 to a supply spigot 28, which may be of the tapered form specified by International Standards or may be similar to spigots 8 to 11 the front face 2 of the bar, this supply spigot forming the outlet for the supply of mixed carrier gas and anaesthetic vapor to the patient.

With the valve in the position shown in the Figures gas from the mixer unit 19 flows through conduit 22, the first bank of the valve and conduit 23 into vaporizer 6. Gas loaded with anaesthetic vapor then flows from vaporizer 6 through conduit 25, the second bank of the valve, conduit 27 and the outlet spigot for supply to the patient.

By changing the position of the valve 20 by rotation of knob 21 the vaporizer 7 may be connected into the circuit rather than the vaporizer 6. It will be seen that the vaporizer that is not connected into the circuit is totally isolated from the gas flow. Cross-contamination of the anaesthetics from the two vaporizers, which may be potentially dangerous, is thus avoided. This parallel connection of vaporizers is not necessary, and the conventional system of series connected vaporizers may be used, and the selector valve then omitted.

The assembly shown in FIGS. 1 to 3 also includes a conduit 29 connecting a supply of pure oxygen from a connection 30 in mixer unit 19 to a valve 31 which may be operated to pass oxygen to the supply spigot 28. This provides an emergency oxygen supply which can be administered to the patient as required by a suitable control 31a for valve 31.

From the foregoing description it will be appreciated that the vaporizers may be removed from and fitted to the rack in a very simple manner, merely by lifting the vaporizer sockets off the spigots or lowering them on to the spigots. When in position on the spigots the vaporizer is held securely on the bar 1. If required, a vaporizer may be removed from the bar and the exposed spigots may then be connected by a connecting block having sockets for fitting over the spigots, the sockets being connected by an internal bore in the block.

FIGS. 4 and 5 show a rack comprising a plate 40 to which are secured two forwardly projecting elements 41, 42 and two rearwardly projecting webs 43, 44. A back plate 45 is fixed to the webs 43, 44. Secured to the rack in a conventional manner are a set of pressure gauges 46, a mixer unit 47, a selector valve 48, and a plate 49 having an emergency oxygen outlet valve control 50 and a gas anaesthetic vapor outlet spigot 51.

The upper web 43 has two sets of spigots 52, 53 and 54, 55 into which sockets on two vaporizers 56, 57 plug as already described, the vaporizers being further supported by element 41. Below the element 41 the plate 40 has two sets of spigots 58, 59 and 60, 61 projecting with their axes perpendicular to the plate 40. Plugged into one set of the spigots are sockets on a volumeter 62, and plugged onto the other set are sockets on a ventilator 63, the volumeter and ventilator being further supported by element 42. The four sets of spigots, the pressure gauges, the mixer unit, the selector valve, the emergency oxygen spigot and the gas/anaesthetic vapor outlet spigot are appropriately interconnected by conduits (not shown) behind the plate 40.

The rack shown in FIG. 4 provides four defined bays, two side by side upper bays for receiving vaporizers, and two side by side lower bays for receiving other anaesthesia units. The bays are designed on the modular principle to accept anaesthesia units constructed to a standard measure of width. The vertical spigots for the upper bays and horizontal spigots for the lower bays do in themselves form an indexing system to prevent vaporizers from being plugged into the lower bays, or other units with horizontal sockets being plugged into the upper bays. If required, other indexing means may be located in some or all the bays, for example keys secured to the rack and engaging keyways on the housings of the units, to further limit the units that can be received by a particular bay.

It will be understood that racks are not limited to the number or arrangement of bays shown, and as many bays as required may be provided. Although in each example two vaporizers have been shown mounted on the rack this is not necessary and only a single vaporizer may be used. If necessary, some bays may be designed for receiving units of electrical equipment, these bays being equipped with an electrical plug or socket to co-operate with the unit.

FIG. 6 shows a typical free-standing form of assembly having a console rack 66 upstanding from a table top 69 which may have means for securing gas cylinders such as 69a and have conduits for connecting the gas cylinders to the console rack. An anaesthesia unit, such as a flowmeter 61 has upper and lower bars 62 and 63 and a vertical back-bar 64. The bars fit into a vertical locating slot in the bay 65 of the console rack 66, and the unit is supported by engagement of the bar 62 beneath an upper bar of the console rack, and engagement of the bar 63 above a lower bar of the console rack. Plugs 67 and 68 on the unit fit into sockets on the console rack to allow flow of fluid through the unit.

Other forms and arrangements of console racks will be readily apparent to those skilled in the art.

In those bays where an inlet and an outlet plug or socket element are provided it is advantageous if the elements are valved to provide a by-pass connection if no anaesthesia unit is present in the bay. FIG. 7 shows an example of such a valving arrangement associated with two sockets 70, 71 on the console rack for receiving plugs 72, 73 on an anaesthesia unit. The sockets 70, 71 have respectively fluid inlet and outlet passages 74, 75 opening into the sockets and the two sockets are interconnected by a connecting passage 76. Each socket has a piston member 77, 78 with an O-ring seal slidable therein and biased by a spring 79, 80 to the position shown for piston member 78, showing the socket 71 with the plug 73 removed. In this position the piston 78

lies above connecting passage 76 and seals the socket against escape of gas. With the piston 77 in a similar position it will be seen that the passages 74 and 75 are interconnected by the sockets and passage 76

On inserting a plug 72 into the socket 70, as shown at the left hand side of the Figure, the piston member 77 is moved against the spring to the bottom of the socket and an internal passage 81 communicates with passage 74, the passage 76 being sealed off by a sealing ring 82 on the plug. A similar connection will be made by plug 73.

Other valving arrangements for achieving the same effect will be readily apparent to those skilled in the art, as will valving arrangements for sealing a single plug or socket element against gas escape if no mating member is in position.

Anaesthesia units in common use that may be designed for mounting on a console rack according to the invention include flowmeters, mixers, volumeters, vaporizers and ventilators. Other units may, for example, be pressure gauges, a blood pressure monitor, a pulse monitor, reservoir bags, a suction unit, emergency oxygen supply, an oxygen lack warning device, an oxygen concentration meter, anaesthetic concentration meters, pressure relief valves, patient breathing and inflating valves, and excess vapor filtration or extraction systems. Any such units may be used in a console rack of anaesthesia units that may be built-up into the form required merely by mounting the units on the console, and engaging plugs and sockets on the units and the console to make the necessary fluid connections.

It will be seen that the invention provides a versatile system wherein installation and removal of anaesthesia units from their support means and supply lines is facilitated.

What I claim is:

1. Anaesthesia equipment including a rack, an anaesthesia unit plugged into position on said rack, at least two fluid-connecting elements on the rack, at least two mating elements on said anaesthesia unit, each one of said fluid-connecting elements engaging with one of said mating elements in plug-in fashion to effect a fluid-conveying connection, an inlet for fluid, an outlet for fluid, and fluid-circuit pipework means fixed to the rack for interconnecting both said fluid inlet with one of said fluid-connecting elements and said fluid outlet with another of said fluid-connecting elements.

2. Anaesthesia equipment according to claim 1 in which said rack and said anaesthesia unit have fluid connecting and mating elements allowing said unit to be plugged into position from the front of said rack, the axes of at least some of said fluid connecting and mating elements being perpendicular to the plane of said rack.

3. Anaesthesia equipment according to claim 1 in which said rack and said anaesthesia unit have fluid connecting and mating elements allowing said unit to be plugged into position from above and to the front of said rack, the axes of at least some of said fluid connecting and mating elements lying in or parallel to the

plane of said rack.

4. Anaesthesia equipment according to claim 1 in which said rack has a front face and a top face perpendicular to said front face, said top face being provided with mating elements having axes perpendicular to said top face, and said front face being provided with mating elements having axes perpendicular to said front face.

5. Anaesthesia equipment according to claim 1 including first and second fluid connecting elements secured to the rack, a by-pass connection interconnecting said first and second fluid connecting elements, and sealing means including valve means operable by the presence of first and second mating elements engaged with said first and second fluid connecting elements respectively to allow fluid to flow through said first and second fluid connecting elements, and in the absence of said mating elements allowing fluid to flow along said by-pass connection.

6. Anaesthesia equipment according to claim 1 and having one or more anaesthesia units secured thereto without plug connections.

7. Anaesthesia equipment according to claim 6 in which a gas mixer unit and a selector valve are secured to the rack without plug connections, the rack has two or more sets of inlet and outlet fluid connecting elements each for engaging mating elements of an anaesthetic vaporizer, and said fluid circuit pipework means connects said gas mixer unit, said selector valve and said inlet fluid connecting elements in such a way that said selector valve may be operated to direct gas from said mixer unit to said inlet fluid connecting element of any selected set.

8. Anaesthesia equipment according to claim 7 in which said selector valve is connected by further fluid circuit pipework means to said outlet connecting elements of said sets and is operative to direct gas from said outlet connecting element of any selected set to a supply outlet, said selector valve being connected to said supply outlet.

9. Anaesthesia equipment according to claim 1 and comprising a number of defined bays each for receiving an anaesthesia unit.

10. Anaesthesia equipment according to claim 9 in which some or all of said bays are provided with indexing means for cooperating with indexing means on anaesthesia units to ensure that only a particular type of unit may be mounted in a particular bay.

11. Anaesthesia equipment according to claim 9 in which some or all of said bays have outlet and inlet fluid connecting elements.

12. Anaesthesia equipment according to claim 9 in which some or all of said bays have electrical plugs or sockets.

13. Anaesthesia equipment according to claim 9 in which some or all of said bays are designed on the modular principle to receive anaesthesia units constructed to a standard measure of length or width or both.

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