'COMPREX'

GENERAL ANÆSTHESIA

UNIT

The 'COMPREX' *General Anæsthesia Unit is covered by the following patents:*

Great Britain	534942
	568212
	564495
Italy	*P.A.* 458756

(*Patents applied for in other countries*)

THE MIE

'COMPREX'

GENERAL ANÆSTHESIA

UNIT

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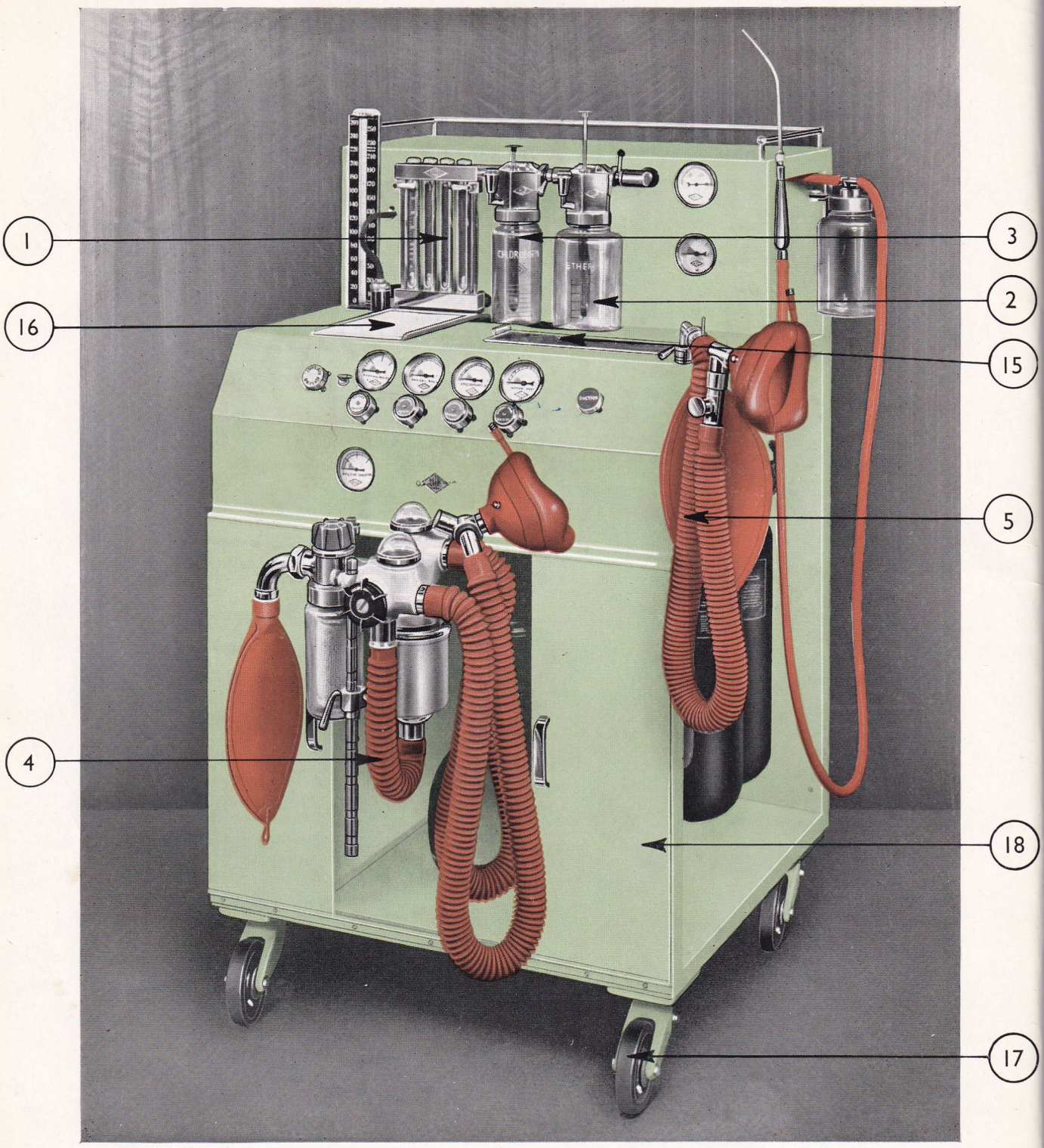

Fig. I: The MIE 'COMPREX' General Anæsthesia Unit

'COMPREX' GENERAL ANAESTHESIA UNIT

(FIG. I)

The MIE 'COMPREX' General Anæsthesia Unit has been designed in collaboration with many of the leading anæsthetists of Great Britain as a *comprehensive* apparatus to meet every requirement for general inhalation anæsthesia. Our aim has been to produce an apparatus, with easily accessible controls, of simple design and robust construction, which will give long and trouble-free service in the busy theatre of a large hospital.

Many of the individual components of the 'COMPREX' have already proved their worth—as one example, the MIE Closed Circuit Unit, which we might justifiably claim to be the choice of leading anæsthetists in all parts of the world.

The accuracy and reliability of rotameters having been proved during many years' use, MIE Individually Calibrated Rotameters are fitted to the 'COMPREX'.

The Blood Pressure Apparatus and the Emergency Suction System will be welcomed, not only by the anæsthetist but also by the surgeon.

The individual controls and circuits of the 'COMPREX' Unit are described in the following pages.

THE CABINET (IA)

See Fig. I

The cabinet of the 'COMPREX' Unit is of unobtrusive modern design, smooth externally, with special mouldings to obviate dust-traps and facilitate cleaning. It is constructed of duralumin, for lightness and strength, and finished in light green, ether-resistant stove enamel.

All exposed metal parts are heavily chromium plated.

The table top incorporates an instrument tray (15) and a special frame (16) to hold anæsthetic record cards.

All the controls are grouped on one panel in the front of the Unit.

The cabinet is mounted on four easy-running ball-bearing castors (17) of the latest 'anti-static' type.

The overall dimensions of the 'COMPREX' Unit are:—

Height	3ft. 7½in.
Width	2ft. 1in.
Depth	1ft. 10in.

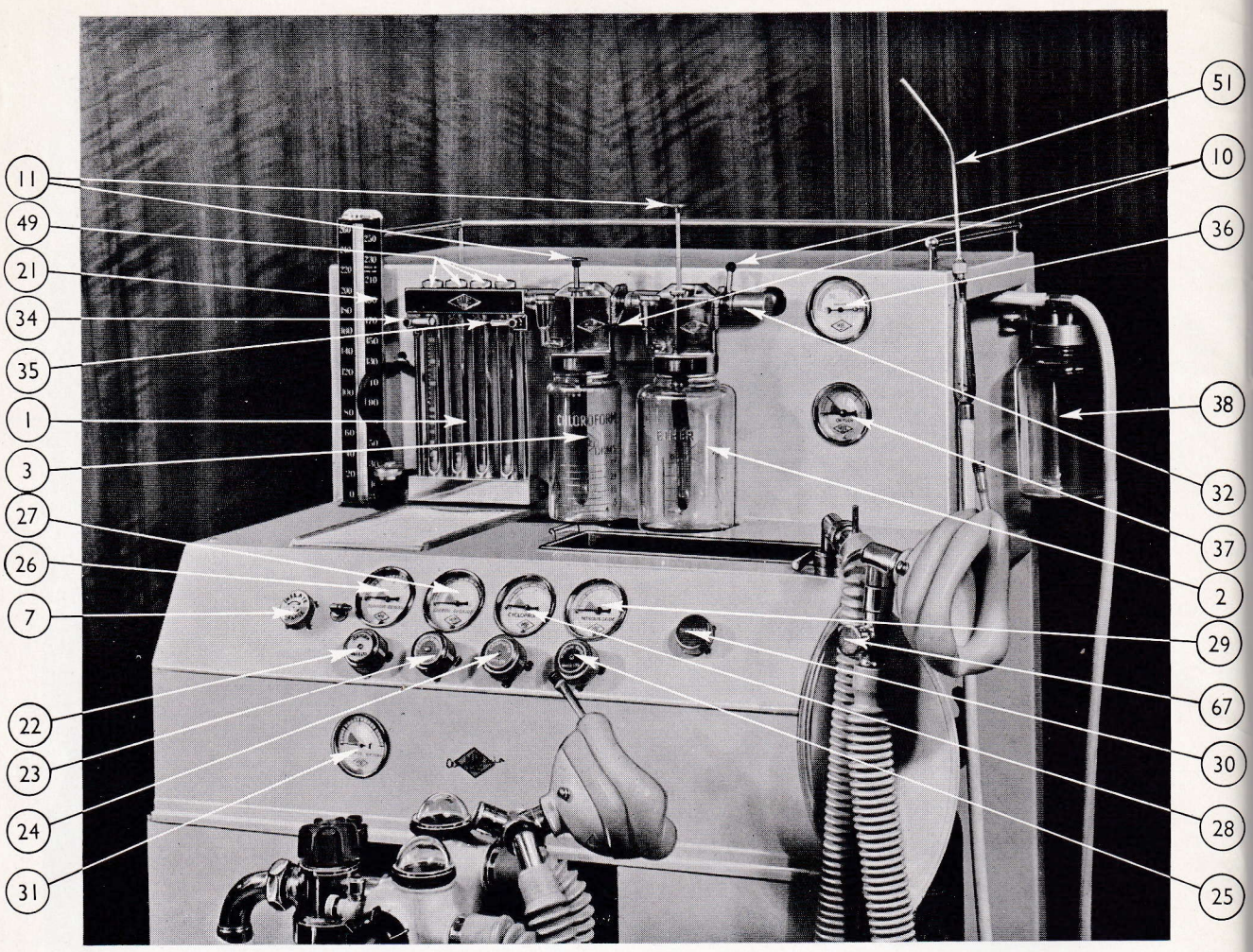

Fig. II

THE CONTROL PANEL

See Fig. II

All the gas controls of the 'COMPREX' are assembled with their respective cylinder contents gauges on one conveniently placed control panel. The controls, from left to right, are:—

Oxygen control (7) for inflating the cuff of the Blood Pressure Apparatus (21).

Four 'ultra-fine' controls for oxygen (22), carbon dioxide (23), cyclopropane (24), and nitrous oxide (25), which operate their respective rotameters. Above each of the control knobs is the relevant cylinder contents gauge (26, 27, 28 and 29). The oxygen gauge records the contents of the running oxygen cylinder only. Below the main oxygen control is a further cylinder contents gauge (31) which records the *reserve* oxygen supply. It will be appreciated that while the oxygen gauges are accurate, in that they will fall steadily as the cylinders are exhausted, the gauges for carbon

dioxide, cyclopropane, and nitrous oxide are only approximate guides and will show 'full' until the cylinders are almost empty and then fall fairly rapidly.

The right-hand control (30) operates the injector suction system. The oxygen supply for this comes from a separate cylinder whose contents gauge is situated on the back panel (37) below the suction gauge (36).

MERCURIAL BLOOD PRESSURE APPARATUS (21)

(Dr. T. M. Williams' Sphygmomanometer Cuff Inflator)

See Fig. II

The control (7) is calibrated in both directions—to the right for inflation of the cuff and to the left for deflation. In use, the control should be turned *back* slowly about half a turn after inflation of the cuff so as to obtain a constant reading.

The mercury column is fitted with a ratchet attachment which enables it to be raised or lowered at will.

The Blood Pressure Apparatus is operated from the *running* oxygen cylinder.

ROTAMETERS (1)

See Fig. II

The bank of four Rotameters provide for the accurate recording of all gas flows. They are calibrated as follows:—

Oxygen	in	100cc. divisions	0–2,000cc. per minute
Carbon Dioxide	in	100cc. divisions	0–2,000cc. per minute
Cyclopropane	in	50cc. divisions	50–750cc. per minute
Nitrous Oxide	in	1,000cc. divisions	1,000–10,000cc. (1–10 litres) per minute

The calibrations of each rotameter tube are in the same colour as the corresponding 'ultra-fine' control.

Wide-bore by-pass controls for oxygen (34) and nitrous oxide (35) provide for an immediate flow of these gases which is independent of the flow in the rotameter tubes.

GRADOLISER Ether (2) and Chloroform/Trilene (3) VAPORISERS

See Fig. II

The simple and efficient Gradolisers are fitted to the Rotameter unit by means of tapered mounts. They provide an extremely smooth application of vapour, the strength of which may be controlled initially by means of the lever (10) operating the drum. The vapour concentration can be increased by depressing the plunger (11) which causes the gases to bubble through the liquid instead of blowing over the surface.

The Gradoliser bottles (6) are removed by unscrewing and lowering through the aperture in the cabinet top. They are then accessible through the doors in the rear of the cabinet (Fig. IX).

EMERGENCY SUCTION SYSTEM

See Fig. II

The suction apparatus works off its own independent oxygen circuit. The control (30) may be locked in the 'on' position by turning it to the right. The degree of suction is recorded by the gauge (36) on the back panel. The suction bottle (38) and tubing with the universal suction handle and end (51), which are illustrated in the working position, may be swung back into a recess in the cabinet when not in use.

It is important to ensure that the suction bottle (38) is screwed tightly into position as, obviously, any leak will lessen the efficiency of the system. Cork washers are provided to maintain a gas-tight joint between bottle and mount.

MIE CLOSED CIRCUIT ABSORBER UNIT (4)

See Figs. III, IV, and V

The MIE Closed Circuit Unit for the Carbon Dioxide Absorption Technique is housed in the cupboard in the front of the 'COMPREX'. It may be operated from either of two positions, drawn forward on the ball-bearing runners (41) till clear of the sliding doors (18) (Fig. 1) or mounted on top of the cabinet by engaging the cam (53) in one of the recessions of the mounting rod (40). In either position the unit can be raised or lowered on the mounting rod (40) so that the re-breathing bag (39) is always conveniently placed for anæsthetists operating the controlled respiration technique.

The advantages of closed circuit anæsthesia may be summarised as follows:—

Heat conservation
Water conservation
Reduction in surgical shock
Improved ether vaporisation
Control of anæsthesia
More normal respiration
Economy of anæsthetic gas consumption

The MIE Closed Circuit Unit is of the circle type. It provides for three positions of control:—

(a) To-and-fro breathing on one tube with no valves in operation (Fig. IV)
(b) Circle breathing without soda lime
(c) Circle breathing with soda lime (Fig. V)

Thus between (b) and (c) varying amounts of carbon dioxide can be retained in the circuit.

In every instance the ether vaporiser (12) is situated in a to-and-fro position. This ether vaporiser is a special feature of the absorber. It is of the surface type and is placed *between the main body of*

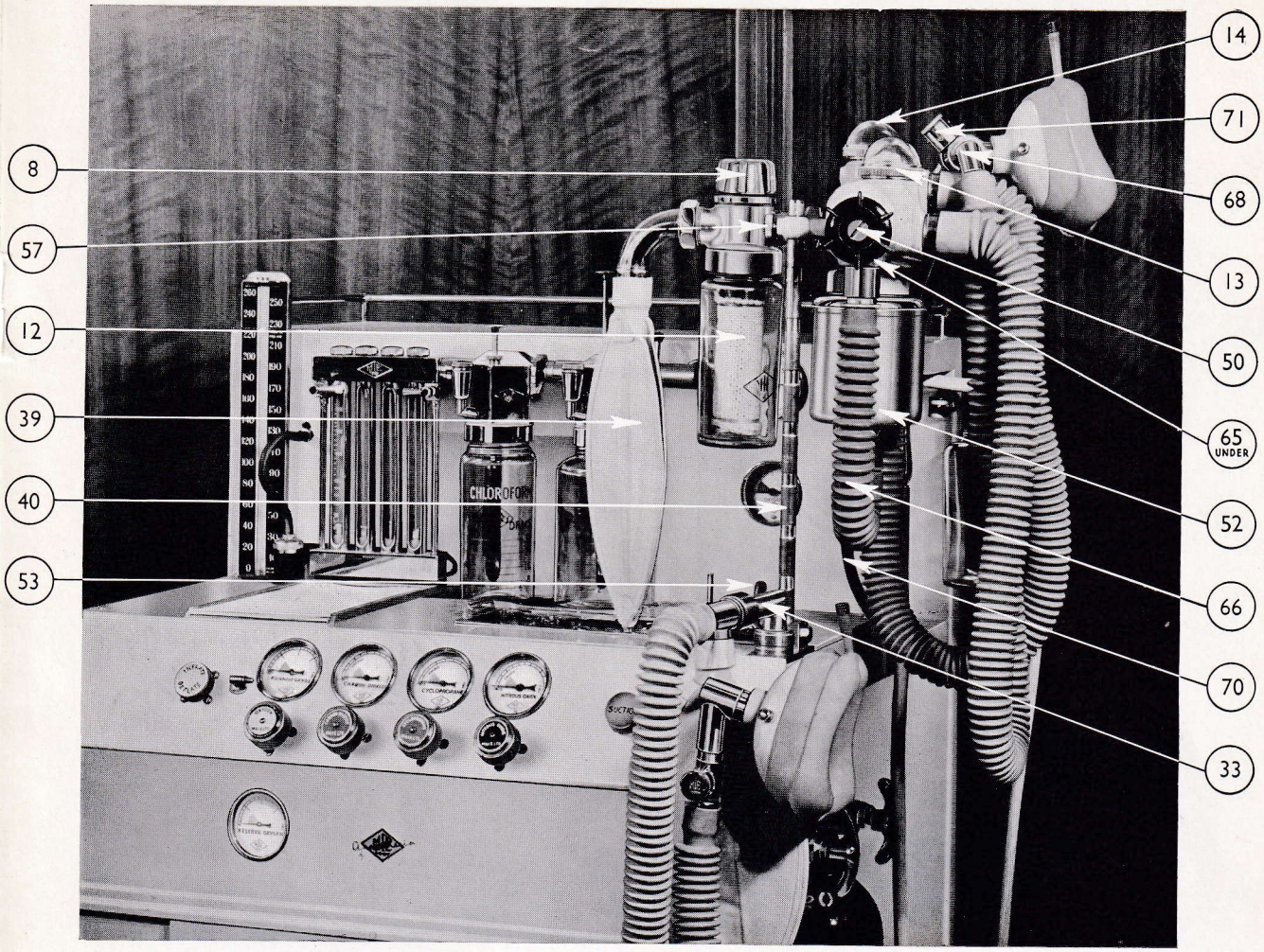

Fig. III

the absorber and the rebreathing bag so that the required proportion of the rebreathed gases is passed over the surface of the ether in *both* phases of respiration. The drum control (8) is placed at the top of the vaporiser. A high concentration of ether vapour, warmed by inspiration and the chemical reaction of the soda lime, may be built up in a very short time. The ether vaporiser may be used either during or after induction. Anæsthetists who prefer to follow their usual induction technique need not bring any part of the Absorber into action until the patient has reached the desired depth of anæsthesia. The ether Gradoliser (2) may first be used in the usual way and the Absorber put into circuit afterwards, supplying any additional concentration of ether from the vaporiser (12).

The soda lime canister (52) is of the pattern originally designed by Dr. Connell, and has a capacity of 1 lb. It is instantly detachable. Two canisters may be supplied to permit 'resting' the soda lime. Fig. V shows the flow of gases when the apparatus is in use as a circuit absorber. When the control (50) is rotated to the 'OPEN' setting, the directional flow is as in Fig. IV. (The direc-

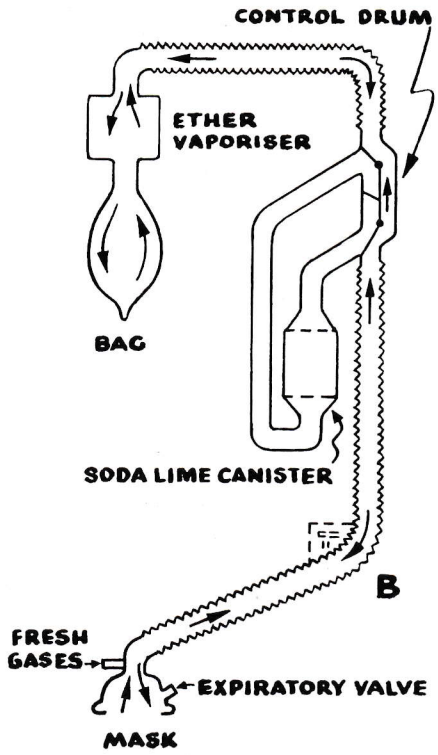

Fig. IV

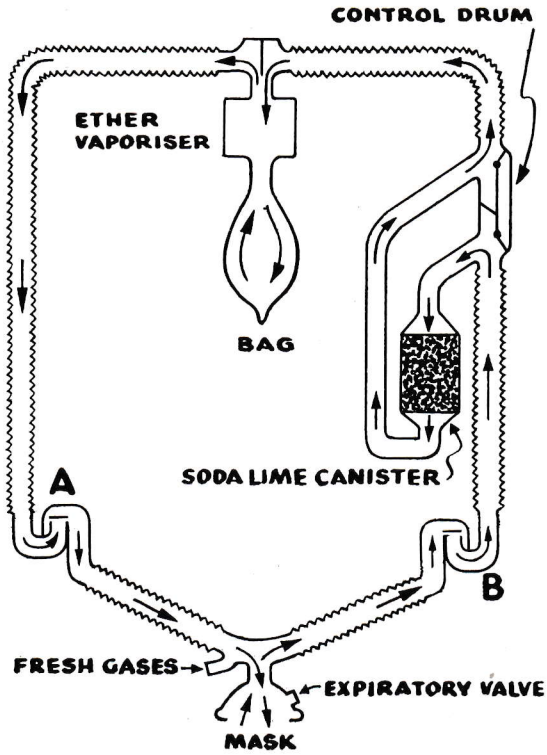

Fig. V

tional valve B, being inoperative at this setting, has been omitted from the diagram and the soda lime canister is out of circuit).

The Magill Flexible 'Y' Piece (68) incorporates an expiratory valve (71) and an inlet feed tube (70) by which all fresh gases are added to the circuit.

The directional valves (13 and 14) which control the circulation of the gases are extremely light in action. They are situated in the main body of the unit, glass covers permitting their action to be kept under direct observation.

Laboratory tests have demonstrated the extremely low resistance of the MIE Closed Circuit Unit—less than $\frac{1}{4}$ inch of water.

MAGILL REBREATHING ATTACHMENT (5)

See Fig. III

When the MIE Closed Circuit Unit is not used, the Magill Rebreathing Attachment is connected to the Cardiff Swivel Unit (33) in place of the Feed Tube (70) of the Closed Circuit Unit.

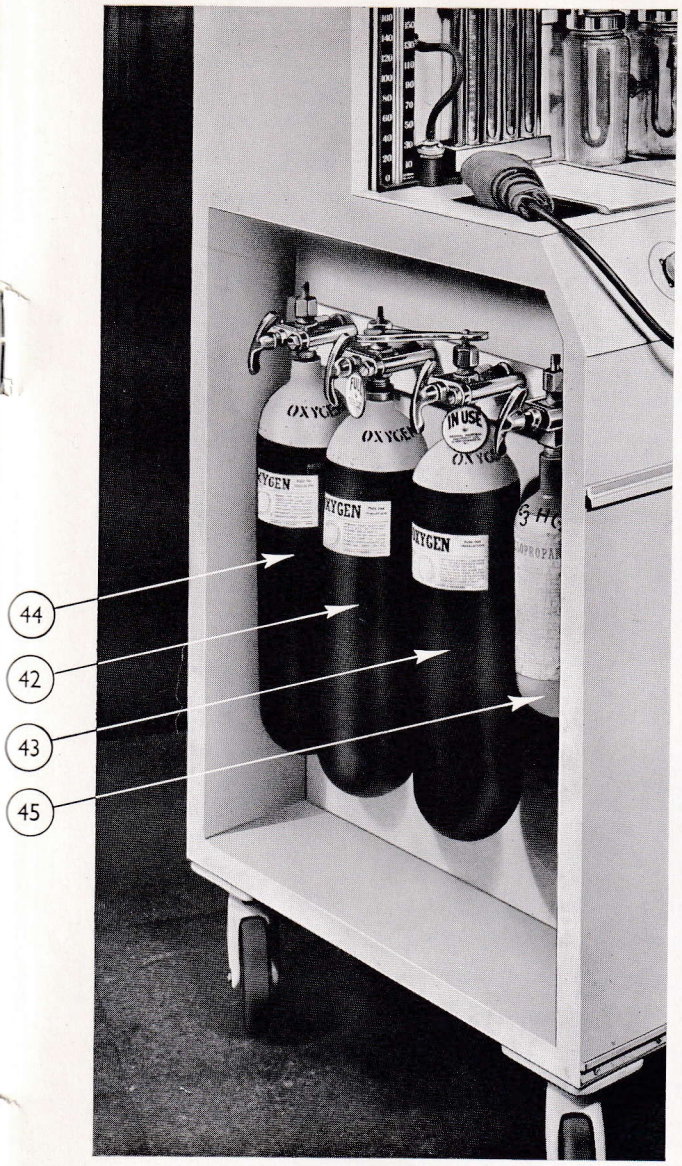

Fig. VI

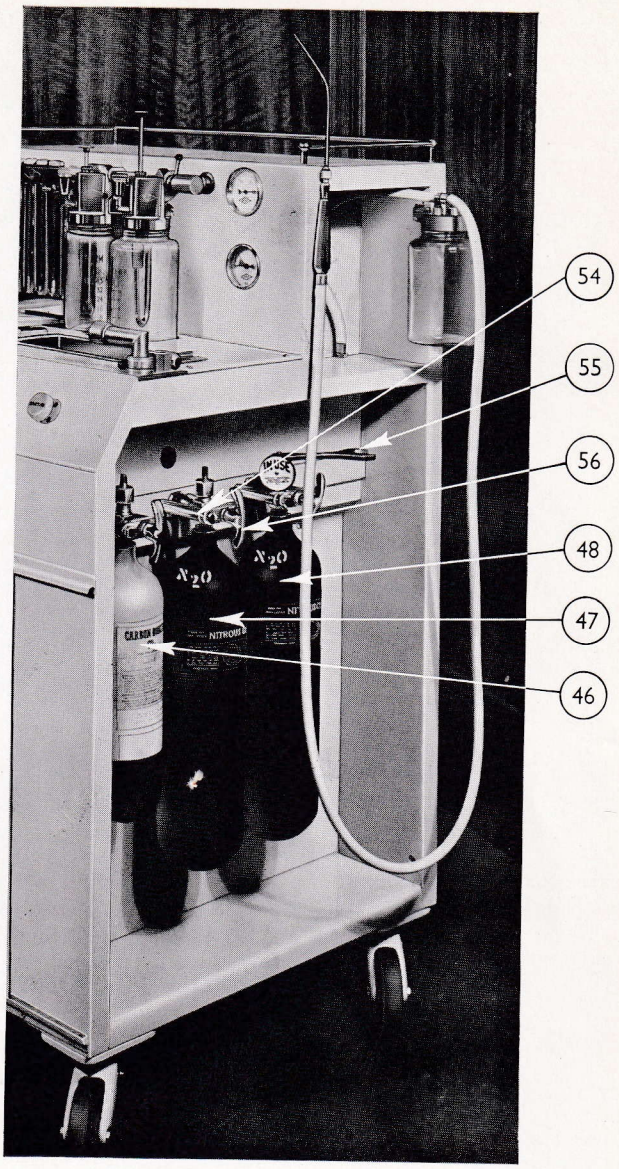

Fig. VII

GAS CYLINDERS

See Figs. VI and VII

Seven Gas Cylinders are fitted in recesses at both sides of the cabinet. On the left-hand side (looking from the front of the Unit) are, from left to right (Fig. VI):—

One 66-gallon Oxygen cylinder type 7 (44) which operates the Emergency Suction System. This cylinder should be turned on at the commencement of every case so that suction may be immediately available in an emergency.

Two 66-gallon Oxygen cylinders type 7, clearly marked RUNNING (42) and RESERVE (43). In order to maintain a full reserve cylinder, the *running* cylinder *only* should be turned on at the beginning of a case. *If both cylinders are put in circuit they will exhaust themselves together. Empty cylinders should be turned off immediately or decanting will occur.*

One 50-gallon Cyclopropane cylinder (45).

On the right-hand side are, from left to right (Fig. VII):—

One 2 lb. Carbon Dioxide cylinder type 7 (46).

Two 200-gallon Nitrous Oxide cylinders (47 and 48)—here again, it is advisable to use one cylinder at a time, keeping the other in reserve. *Empty cylinders should be turned off immediately to avoid decanting.*

All cylinder yokes (54), which are fitted with non-return valves, are clearly marked. The cylinder keys (55) provided can also be used for tightening the gland nuts if a leak occurs at the spindle. When fitting cylinders, ensure that the cylinder outlet is located squarely to the face of the fibre washer before clamping firmly into position by means of the thumb screw (56). Spare fibre washers are supplied with the unit.

Yokes to accommodate American or Continental type cylinders can be fitted if required.

Non-interchangeable pipe-line attachments can be supplied to special order.

SERVICING THE APPARATUS

The 'COMPREX' has been designed to reduce maintenance time and cost to the very minimum —all gas regulators are totally enclosed; silver-soldered copper piping is used for all interior connections, thus avoiding the constant replacement of rubber parts; and all component assemblies, rotameter bank, Gradolisers, etc., can be simply removed and replaced. It will, of course, be appreciated that servicing can best be carried out in our own workshops by our own trained personnel. It is realised, however, that this is not always possible and so a summary of essential servicing points is given below.

1. Rotameter Bank (1)

The Rotameter Tubes must be cleaned from time to time. The need generally becomes apparent when the bobbins fail to rotate or tend to stick in one position.

Remove the four knurled caps (49) and their washers and withdraw the tubes from the mounting. Clean the tubes and bobbins with ether, ensuring that not only the fins but also the insides of the bobbins are free of dust. Do not wipe with a cloth as small particles of cloth tend to adhere and impede the working of the bobbin. When replacing, make certain that the rotameter tubes are upright. This can be checked by passing gas through the system and seeing that the bobbin rotates freely at all flow rates.

2. By-Pass Controls (34 & 35)

These must be kept lubricated. Remove the controls by unscrewing the locking nut at the rear of the housing. When refitting, ensure that the aperture in the control which corresponds to the by-pass tube is not obstructed with grease

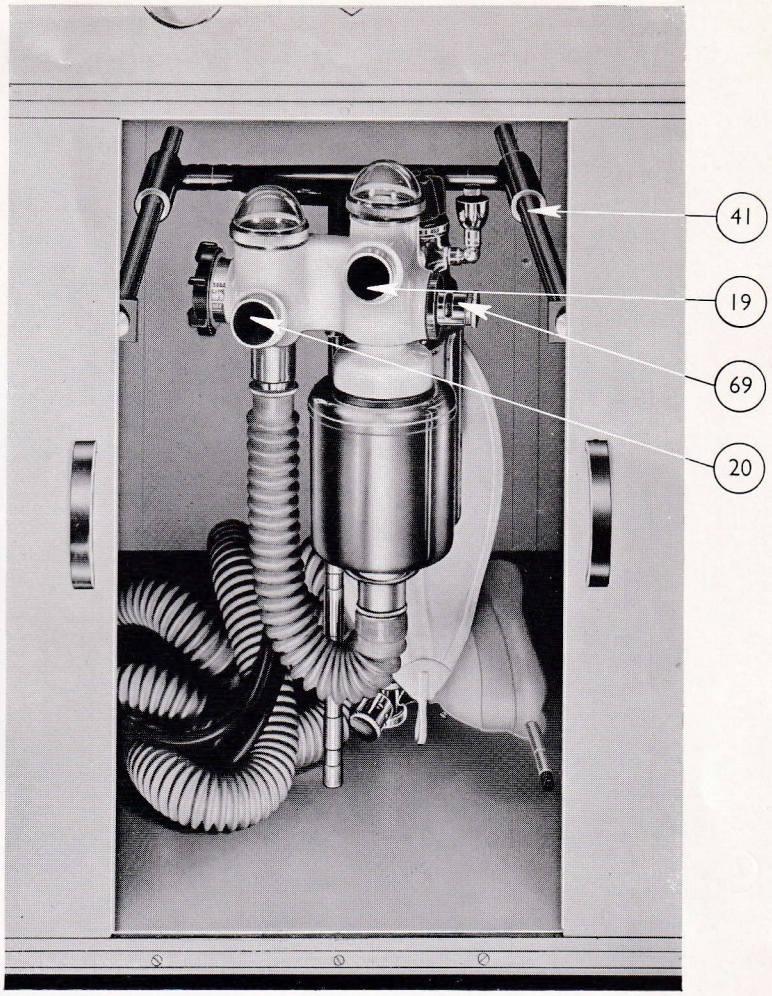

Fig. VIII

3. Gradoliser Ether (2) and Chloroform/Trilene (3) Vaporisers

After some use, the drums will dry off and require regreasing. To do this the complete rotameter-Gradoliser assembly must be removed by unscrewing the three hexagonal nuts (9) which hold the assembly mount (32). These nuts are easily reached through the doors at the back of the cabinet (Fig. IX).

Unscrew the controls (10) and carefully withdraw each drum with the forefinger. Regrease with the lubricant provided and replace. Remove the plungers (11) by loosening the small knurled nuts. Rewind the packing with lubricant and replace the plungers.

When replacing the assembly ensure that all the parts are securely fitted into position. Check for leakage by passing gas through the rotameters and Gradolisers (which must be in the 'OFF' position at the time of blocking the Cardiff Swivel Unit (33). If there is no leakage the rotameter bobbins will fall to the bottom of the tubes as pressure builds up.

4. MIE Closed Circuit Unit (4)

(a) *Ether Vaporiser* (12)

The drum requires periodical lubrication. Remove by unscrewing the small knurled screw (72) and withdrawing drum by means of the control (8). Regrease with the special lubricant and replace, securing by the knurled screw (72).

(b) *Soda Lime Control* (50)

The drum requires periodical lubrication. Remove the small screw (65) situated below the control (50), withdraw the drum, regrease with the lubricant provided, and replace, securing it by means of the screw (65).

(c) *Directional Valves* (13 & 14)

These are easily removed by unscrewing the domed housing. They should be removed and dried after every case. When replacing the domed housings, screw them right home and check for leakage by filling the rebreathing bag (39), blanking off outlets (19 and 20), and applying pressure to the bag (39).

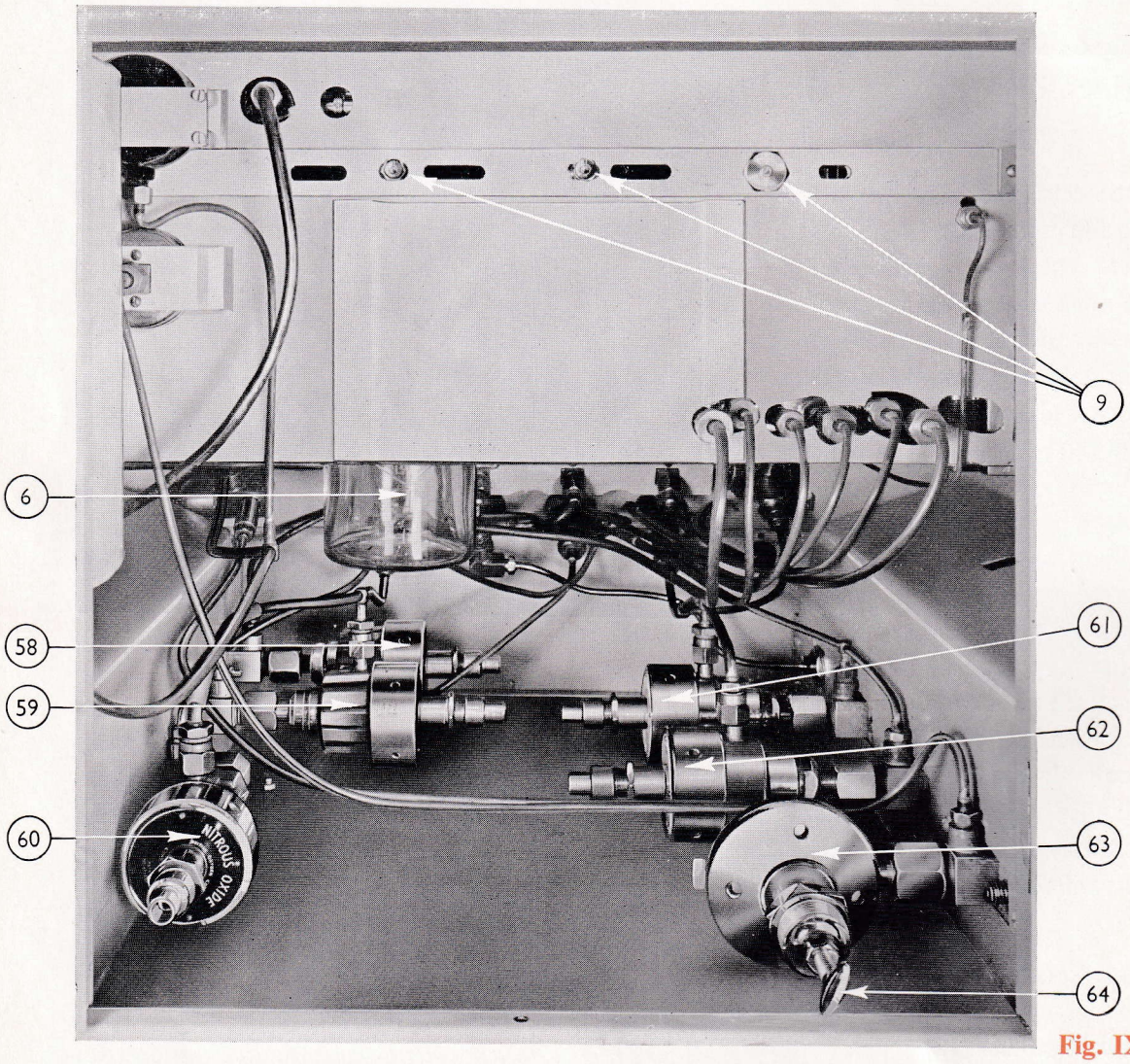

Fig. IX

5. Gas Regulators (Low Pressure) (58, 59, 60, 61 & 62)

If a leakage of gas is noticed from the escape holes in the outer casings of these regulators, it indicates that the rubber bellows need replacing. A service exchange system is in operation. The

parts in question will be supplied immediately on receipt of a request quoting the above reference numbers.

These low pressure regulators are set to an outlet pressure of 5 lb. per square inch.

6. Gas Regulator (High Pressure) (63)

This regulator, which operates the Emergency Suction System, has an outlet pressure of 60 lb. per square inch. The butterfly setting screw (64) is locked into position and should not be touched. As no rubber is used in the construction of this regulator, it will operate for very long periods without attention.

A service exchange system is operated under reference (63).

'COMPREX' GENERAL ANAESTHESIA UNIT

The 'COMPREX' General Anæsthesia Unit consists of two separate pieces of apparatus. First, the two Gradoliser Vaporiser Units for chloroform/Trilene (3) and ether (2), a reservoir bag, breathing tube, expiratory valve and mask, forming a semi-closed system and generally referred to as a Magill Rebreathing Attachment (5). Secondly, there is the MIE Closed Circuit Absorber Unit (4), with its own vaporiser (12), breathing tubes, etc. The Rotameters (1) are used with either the closed (4) or semi-closed (5) system. Additional items of equipment such as a Mercurial Blood Pressure Apparatus (21) and Emergency Suction Apparatus (30) are also fitted.

When using the apparatus the system selected is first connected to the Rotameters (1), fluid agents are added to the Gradoliser Vaporiser bottles (3) and (2) as required, and a charge of soda lime placed in the canister (52) if the absorption method is to be employed. The cylinders (42, 44, 45, 46, 47), which have previously been connected to the apparatus, are then turned on and the 'ultra-fine' controls (22, 23, 24, 25) checked to see that they are fully turned on. A suitable sized facepiece is selected and connected to the apparatus which is now ready for use.

Let us suppose it is desired to use the Magill Rebreathing Attachment (5) to anæsthetise a patient with gas, oxygen and ether. The patient will have had suitable pre-medication an hour beforehand. Anæsthesia may be induced with an intravenous barbiturate, the method preferred by most patients. Suitable flows of gas and oxygen are then turned on and the mask applied to the patient's face. The mask may be secured to the face, if desired, with a harness designed for this purpose. The introduction of ether to the system can be made very gradual by judicious use of the Gradoliser Vaporiser Unit (2). The lever (10) deflects more or less of the fresh gases through

the bottle and the plunger (11) further modifies the concentration of ether by causing the gases to either blow over or bubble through the ether.

The Magill Expiratory Valve (67) is adjustable and the amount of rebreathing is a function of the tension on the valve spring in conjunction with the gas flow rate.

If it is desired to use a Closed Circuit the Absorber Unit (4) is connected at (33). When the Canister (52) is filled with soda lime it should be shaken and blown through to remove dust and some 10 cc. of water added to the charge before the canister is connected to the apparatus.

Suitable gas flows are turned on (22, 23, 24, 25) and the mask applied to the patient's face as in the semi-closed technique above.

An airtight fit at the mask is essential and it will be found that the MIE Flexible 'Y' Piece (68) is a great assistance in ensuring this. It is usual to leave an expiratory valve open for a short time and when it is decided to close the circuit it must be remembered that there are two such expiratory valves, one on the Absorber (69) and the other on the Flexible 'Y' Piece (71).

The Soda Lime Control (50) should be turned on when the circuit is closed to avoid an accumulation of carbon dioxide. Most anæsthetists do not use intermediary positions of the Soda Lime Control (50), having it turned 'full on' or 'off'.

Gas flows are now readjusted. A basic flow of oxygen will be required throughout the anæsthetic to replace that metabolised. Other agents are added until a sufficiently deep plane of anæsthesia has been obtained and then turned off. Small quantities will have to be added from time to time to make up for leaks and other losses.

The foregoing gives an outline of the mode of operation. It will of course be appreciated that no instruction of this type can replace experience gained by working with the apparatus under the guidance of a skilled anæsthetist.

MADE IN ENGLAND

'COMPREX' GENERAL ANAESTHESIA UNIT

CATALOGUE FIG. I

EXTERNAL COMPONENTS

CATALOGUE FIG. NO.	'COMPREX' FIG. NO.	
—	1A	Cabinet
1005	1	Rotameter Unit
1039A	2	Gradoliser—Ether Unit
1039	3	Gradoliser—Chloroform Unit
305	4	M.I.E. Closed Circuit Absorber Unit
1160	5	Magill Rebreathing Attachment
—	6	Gradoliser Bottles
2156	7	Inflate-Deflate Control for Blood Pressure Apparatus
—	8	Absorber Vaporiser Control
—	9	Rotameter—Gradoliser Assembly Nuts
—	10	Gradoliser Drum Control levers
—	11	Gradoliser Control Plungers
360	12	Absorber Ether Vaporiser
—	13	Absorber Directional Valve
—	14	Absorber Directional Valve
—	15	Instrument Tray
—	16	Frame for Anæsthetic Record Cards
—	17	Castors, Anti-Static type
—	18	Front Sliding Doors
—	19	Absorber Outlet
—	20	Absorber Outlet
2151	21	Mercurial Blood Pressure Apparatus
—	22	Oxygen Supply Control
—	23	Carbon Dioxide Supply Control
—	24	Cyclopropane Supply Control
—	25	Nitrous Oxide Supply Control
1280	26	Oxygen Cylinder Contents Gauge (Running)
—	27	Carbon Dioxide Cylinder Pressure Gauge
—	28	Cyclopropane Cylinder Pressure Gauge
—	29	Nitrous Oxide Cylinder Pressure Gauge
—	30	Emergency Suction Control
—	30A	Emergency Suction Bottle Cap and Tapered Connections
—	30B	Emergency Suction Tubing
1280	31	Reserve Oxygen Contents Gauge
—	32	Rotameter—Gradoliser Assembly Outlet Mount
1159	33	Cardiff Swivel Unit
—	34	Rotameter Unit By-pass Control Oxygen side
—	35	Rotameter Unit By-pass Control Nitrous Oxide side
1280	36	Suction Gauge
1280	37	Oxygen Contents Gauge for Suction System
1365	38	Suction Bottle, Plain
1245B	39	Absorber Rebreathing Bag
—	40	Absorber Mounting Rod
—	41	Absorber Cabinet Mounting Runners
—	42	Oxygen Cylinder (Running) size 66 gal., type 7
—	43	Oxygen Cylinder (Reserve) size 66 gal., type 7
—	44	Oxygen Cylinder for Suction System, type 7
—	45	Cyclopropane Cylinder, 50 gal. size
—	46	Carbon Dioxide Cylinder, type 7, 2 lb. size
—	47	Nitrous Oxide Cylinder, type 7, 200 gal. size
—	48	Nitrous Oxide Cylinder, type 7, 200 gal. size
—	49	Rotameter Tube Knurled Retaining Caps
—	50	Absorber Soda Lime Control
S.5010 S.5006	51	Universal Suction Handle and end
355	52	Absorber Soda Lime Canister
—	53	Absorber Outside fixing Cam for 40
—	54	Cylinder Fixing Yokes
1355	55	Cylinder Spanner Key
495	55A	Cyclopropane Key
—	56	Cylinder Clamping Thumb Screws
—	57	Absorber Retaining Screw
1260	58	Carbon Dioxide Adams Reducing Valves, L.P.
1260	59	Nitrous Oxide Adams Reducing Valves, L.P.
1260	60	Nitrous Oxide Adams Reducing Valves, L.P.
1260	61	Oxygen Adams Reducing Valves, L.P.
1260	62	Oxygen Adams Reducing Valves, L.P.
1292	63	Reducing Valve for Suction System, High Pressure

CATALOGUE FIG. NO.	'COMPREX' FIG. NO.	
—	64	Regulator Setting Screw on High Pressure Valve only
—	65	Absorber Drum Retaining Screw
—	66	Soda Lime Corrugated connection
1185	67	Expiratory Valve on Magill Rebreathing Attachment
350	68	MIE Flexible 'Y' piece
—	69	Expiratory Valve on Circle Absorber
450	70	Absorber Feed Tube for Fresh Gases
—	71	Expiratory Valve on Flexible 'Y' Piece
—	72	Absorber Vaporiser Drum Retaining Screw

INTERNAL COMPONENTS

'COMPREX' FIG. NO.		
101	Blue	Copper Supply Tube from Gradoliser to Outlet
102	Black	N_2O Low Pressure Copper Tubing Assembly
103	Black with White Stripes	N_2O Low Pressure Copper Tubing Assembly from Fine Adjustment Control to Rotameter Unit
104	Black & Pink	N_2O High Pressure Copper Tubing Assembly
105	Yellow	Suction Copper Tubing Assembly, Suction side
106	Yellow & Blue	Suction Copper Tubing Assembly from McKesson Regulator to Suction Control
107	Yellow & White	Suction Copper Tubing Assembly High Pressure side
108	—	High Pressure Yoke Tubing Assembly Blocks (4 off)
109	Red	Cyclopropane Copper Tubing Assembly from Fine Adjustment Control to Rotameter Unit
110	Red & Black	Cyclopropane Copper Tubing Assembly from Fine Adjustment Control to Cyclopropane Contents Gauge
111	Red & Silver	Cyclopropane Copper Tubing Assembly from Yoke to Fine Adjustment Control
112	Green	CO_2 High Pressure Copper Tubing Assembly from Cylinder Yoke to Contents Gauge
113	Green & Blue	CO_2 Low Pressure Copper Tubing Assembly from Regulator to Fine Adjustment Control
114	Green & Silver	CO_2 Low Pressure Copper Tubing Assembly from Fine Adjustment Control to Rotameter Unit
115	Pink	Blood Pressure Apparatus Low Pressure Copper Tubing Assembly from Inflate/Deflate Control to Mercury Column
116	White	O_2 Low Pressure Copper Tubing Supply Assembly
117	White & Blue	O_2 High Pressure *Reserve Line* Copper Tubing Assembly to Contents Gauge
118	White & Brown	O_2 High Pressure *Running Line* Copper Tubing Assembly to Contents Gauge
119	White & Gold	O_2 Low Pressure Copper Tubing Assembly from Fine Adjustment Control to Rotameter Unit
120	Blanks for Testing—hexagon screwed	
121	N_2O Yoke Block Housing for non-return valve (angled)	
122	Non-return Valve Assemblies	
123	N_2O Inlet non-return Valve Housing (straight)	
124	Sphygmomanometer (Table Attachment) Tubing Outlets (1 straight, 1 curved)	
125	Sphygmomanometer Ratchet Attachment for raising and lowering	

★ *The name* 'TRILENE' *is a registered trade mark of I.C.I. (Pharmaceuticals) Ltd.*

Trade Mark

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