CAVENDISH APPARATUS FOR GENERAL ANAESTHESIA

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The CAVENDISH APPARATUS

. . . has been designed in collaboration with many of the leading anaesthetists of Great Britain as a comprehensive unit to meet every requirement for general inhalation anaesthesia. 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 theatres of large hospitals.
Many of the individual components have already proved their worth; as one example, the 'Lincoln 800' Closed Circuit Unit – a unit of advanced design with transparent Soda Lime Canister and Emergency Oxygen Flush Control. The accuracy and reliability of Rotameters have been proved during many years' use – MIE Individually Calibrated Rotameters are fitted as standard equipment. The various controls and circuits are described in the following pages.

The CAVENDISH Apparatus for General Anaesthesia consists of two separate pieces of equipment:

1 A semi-closed circuit comprising vaporiser units for chloroform/ether and trichloroethylene and a reservoir bag, breathing tube, expiratory valve and mask which form the Magill Reservoir Assembly.

2 The Closed Circuit Unit.

- The Rotameters are used with either the closed or semi-closed system. Suction and blood pressure units are fitted as optional extras.
- The table is of polished stainless tubular construction, size 24×17×34 ins (61×43×86 cm) and is fitted with anti-static ball-bearing castors.
- Cylinders are accommodated on each side of the table in gate yokes designed to accommodate the pin-index system flush type cylinder valves.
- The large stainless table top serves as a useful surface for placing instruments and accessories.
- A large drawer at the base of the table provides ample storage accommodation for instruments and accessories.
- The Closed Circuit Unit is mounted on an adjustable upright which enables it to be placed in a convenient position for the anaesthetist.
  It may be housed beneath the upper shelf when not in use.
- All fittings are heavily chromium-plated.
- Provision is made for six gas cylinders in groups of three on each side of the unit: Left side 3×24 cu. ft oxygen. Right side 2×200 or 2×400 gallons nitrous oxide 1×50 gallons cyclopropane.

  The Cavendish Unit can also be supplied with nut fittings (one each side) for continental 5 litre cylinders, or with an attachment at the rear for holding the continental type 10 litre cylinders for oxygen and nitrous oxide.

FOR GENERAL ANAESTHESIA

BASIC COMPONENTS

1 Four block – three gas Rotameter unit for oxygen, nitrous oxide and cyclopropane. Ref. 1025

2 Halothane Temperature Compensated Vaporiser. Ref. 1037

3 Oxygen Flush Control Unit. Ref. 1028

4 Pin Index Cylinder Yokes for oxygen, nitrous oxide and cyclopropane. Ref. 1431

5 Gauge Panel indicating cylinder contents. Ref. 1283

6 Lincoln Twin Canister CO_2 Absorption Unit. Ref. 310

7 Magill Reservoir Assembly. Ref. 1160

8 Lightweight Circle Twin Connection. Ref. 351

9 Trichloroethylene Safety by-pass. Ref. 1032

10 *POLISHED* stainless steel table frame. Ref. 31

Ether Gradoliser Vaporiser. Ref. 1034
Not illustrated. Alternative to 12.

OPTIONAL EXTRAS AND ALTERNATIVES TO BASIC UNIT

11 Sphygmomanometer Ref. 2151
as illustrated, or
Oscillotonometer Von Recklinghausen
Not illustrated. Ref. 2158

12 Ether Temperature Compensated Vaporiser. Ref. 1034

13 Injector suction unit. Ref. 3505

14 Blood pressure oxygen cuff inflator. Ref. 2156

15 Trilene (Trichloroethylene) Temperature Compensated Vaporiser. Ref. 1036

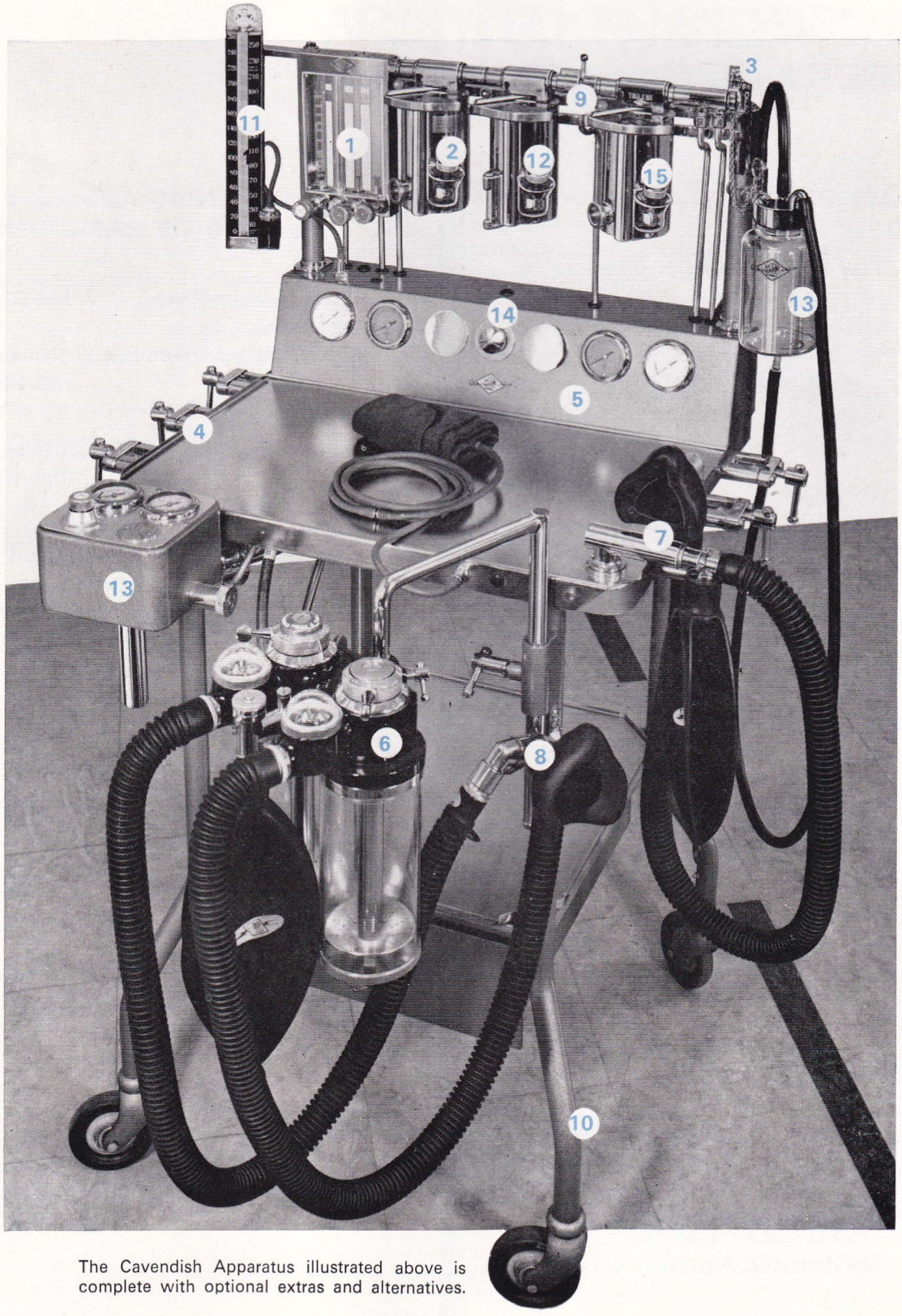
Four gas Rotameter Unit with provision for CO_2. Ref. 1025

Chloroform Gradoliser. Ref. 1039c
Not illustrated. Alternative to 15.

MIE Circle Absorber. Ref. 305
Not illustrated. Alternative to 6.

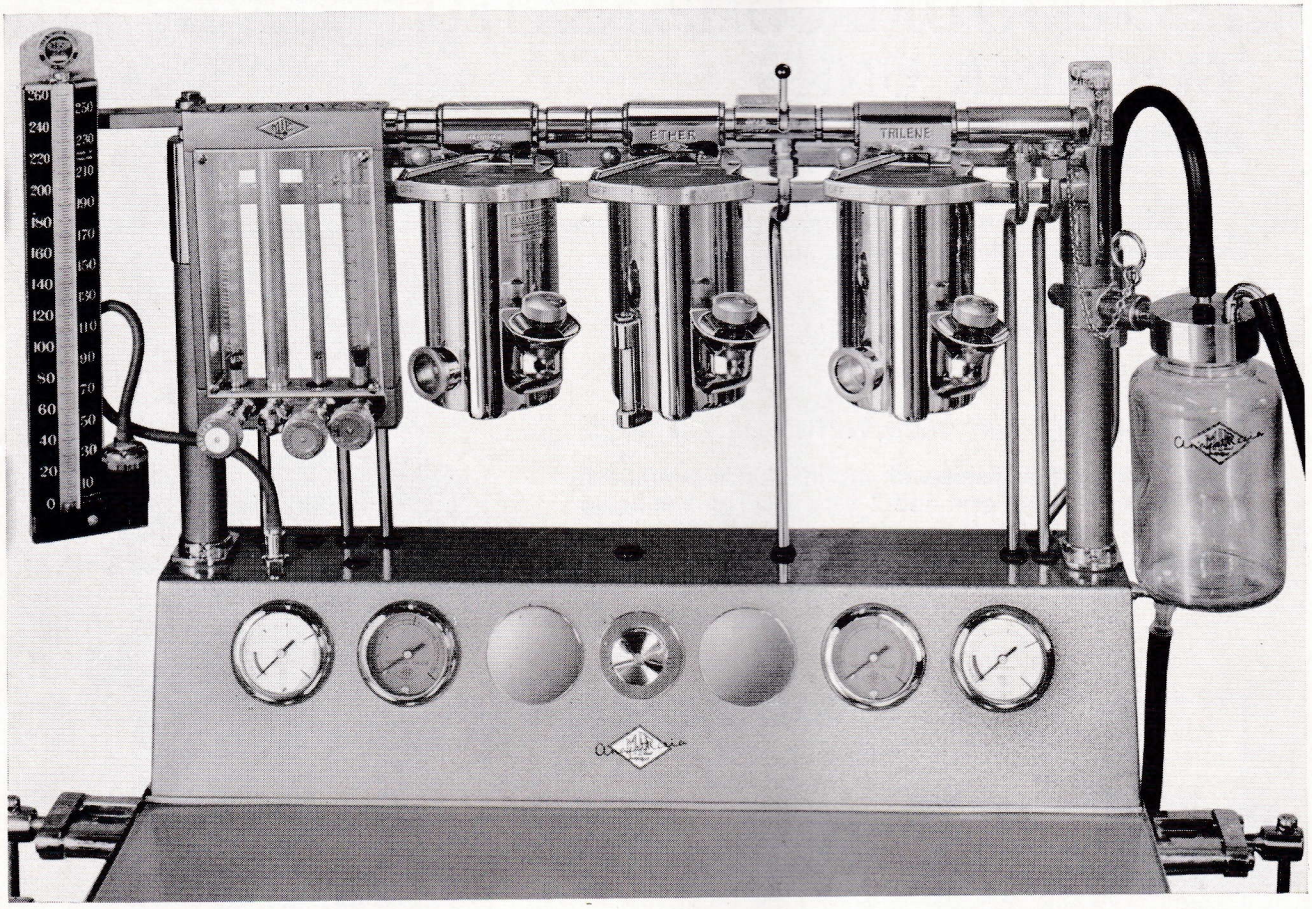
Table frame only in enamel finish. Ref. 31
Not illustrated. Alternative to 10.

Penthrane Temperature Compensated Vaporiser. Ref. 1033
Not illustrated. Alternative to 12.



The Cavendish Apparatus illustrated above is complete with optional extras and alternatives.

ROTAMETERS



A bank of three Rotameters is fitted to the extended top rail of the table. These provide for the accurate recording of gas flows for which the oxygen tube is calibrated in 100 cc. divisions 0–5000 cc. per minute; cyclopropane in 50 cc. divisions 50–750 cc. per minute; and nitrous oxide in 1 litre divisions 1–10 litres per minute.

Each Rotameter tube is calibrated in colours which correspond to the appropriate ultra-fine controls.
A Direct Oxygen Flush Control provides an immediate flow of 60 litres per minute.
A CO_2 circuit is available as an extra.

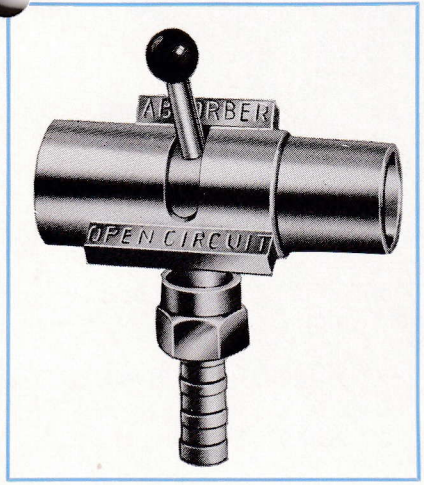


FIG. 1032

TRICHLOROETHYLENE SAFETY BY-PASS CONTROL

Fitted as standard to the Cavendish Apparatus for General Anaesthesia, the unit illustrated prevents the use of trichloroethylene when the control is in the 'absorber' position.
With the control in the 'open circuit' position, the 'absorber' is by-passed and the administration of trichloroethylene is possible only via the Magill Reservoir Assembly fitted to the Cardiff Swivel Attachment.
The gas feed tubing, for Closed Circuit anaesthesia, is fitted to the distal end of the trichloroethylene safety by-pass control located below the upper shelf.

TEMPERATURE COMPENSATED VAPORISER UNITS

. . . are designed to provide the accuracy demanded by modern anaesthetic techniques and to supersede the existing Boyle type units.

The following units are available:

HALOTHANE 'TEN', 'FOUR', or 'TWO'

Three models are available with maximum concentrations of 10 per cent, 4 per cent and 2 per cent. The free liquid capacity of the Halothane models is 110 cc.; stabilising wicks absorb a further 60 cc.

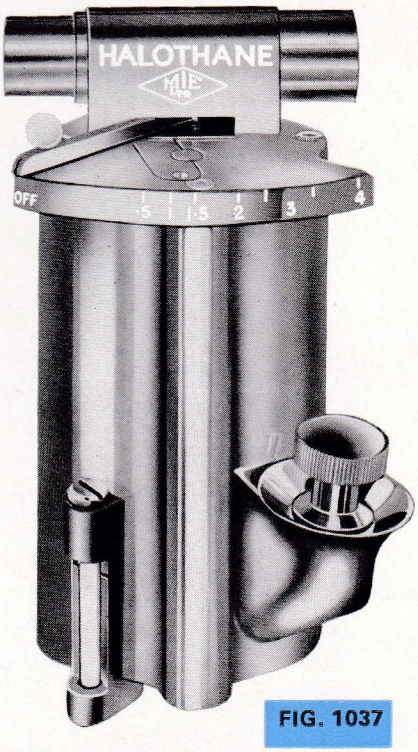


FIG. 1037

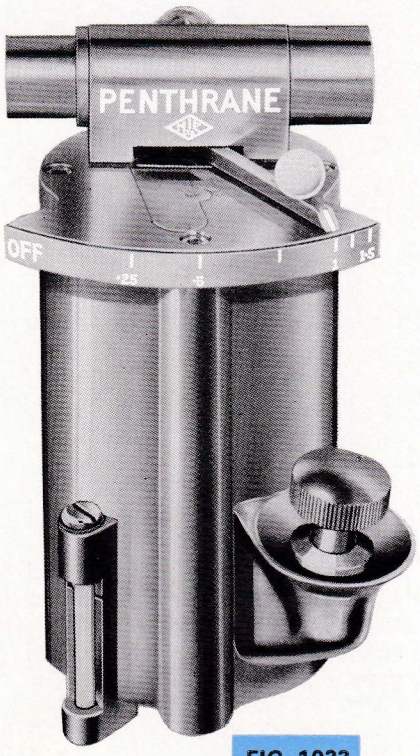


FIG. 1033

PENTHRANE *(Methoxyflurane)* 'ONE POINT FIVE'

The Penthrane unit has a maximum concentration of 1·5 per cent. Penthrane is ideally suited for all levels of anaesthesia, and is non-inflammable.
The free liquid capacity of the Penthrane unit is 110 cc.; stabilising wicks absorb a further 60 cc.

'Penthrane' is the trade mark of Abbott Laboratories Limited.

TEMPERATURE COMPENSATED VAPORISER UNITS *(cont.)*

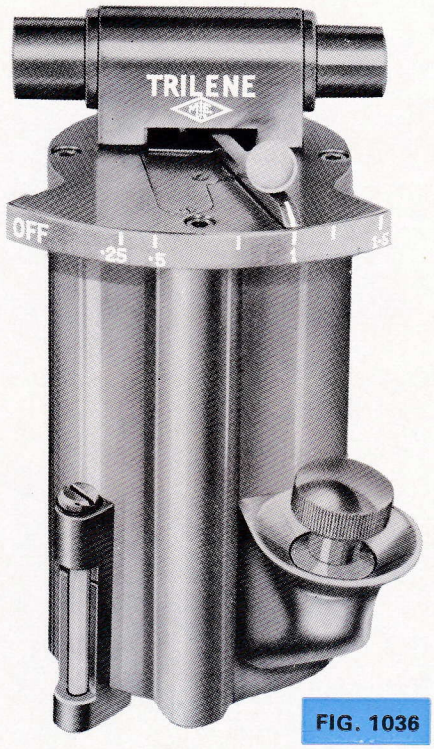


FIG. 1036

TRILENE *(Trichloroethylene)* 'ONE POINT FIVE'

The Trilene unit has a maximum concentration of 1·5 per cent.

Trilene should not be administered for deep level anaesthesia, and should not be used with closed circuit anaesthesia.

The free liquid capacity of the Trilene unit is 110 cc.; stabilising wicks absorb a further 60 cc.

'Trilene' is the registered trade mark of I.C.I. Ltd.

ETHER 'TWENTY'

The Ether unit has a maximum concentration of 20 per cent. The free liquid capacity of the Ether unit is 110 cc.; stabilising wicks absorb a further 85 cc.

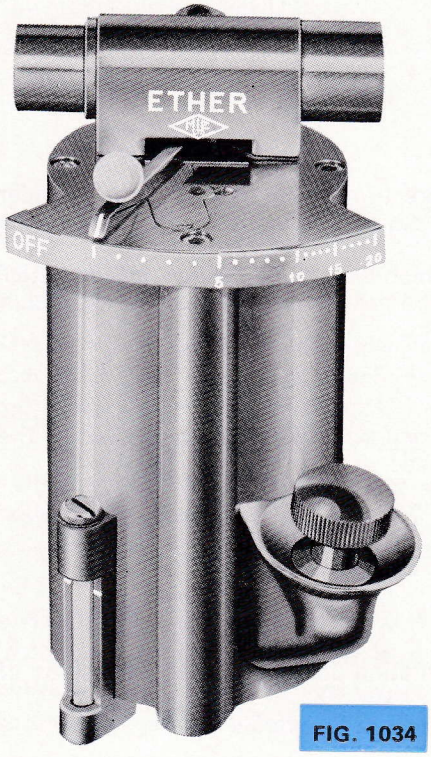


FIG. 1034

GRADOLISER
(BOYLE TYPE)
ETHER OR CHLOROFORM
VAPORISERS

The simple and very efficient Gradolisers provide an extremely smooth application of vapour, the initial strength of which is determined by the position of the lever operating the drum.

FIG. 1039

INJECTOR SUCTION UNIT

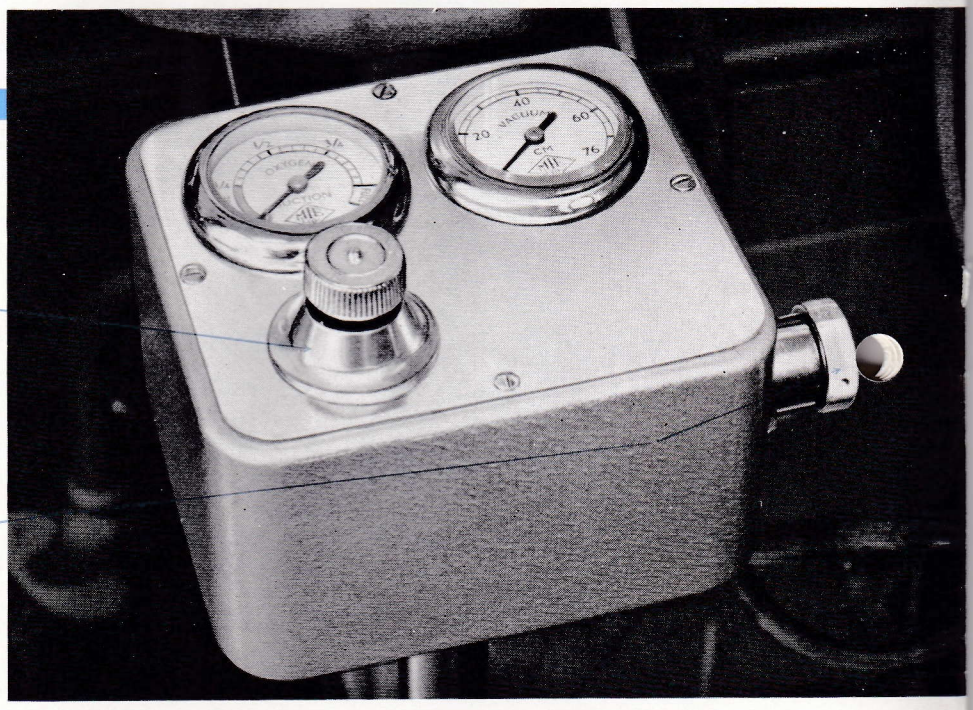


FIG. 3503

SUCTION ASSEMBLY

Based on the injector principle, the suction assembly operates direct from a 24 cu. ft oxygen cylinder fitted into a pin index gate type yoke. A negative pressure of 55 cm of mercury is obtainable and the unit is quiet in operation.
Consumption of oxygen is approximately 25 litres per minute which will permit twenty-four minutes' continuous suction from a 24 cu. ft cylinder. Air displacement at 25 litres flow is 18 litres. The aspiration rate of liquid solutions is $1\frac{1}{2}$ litres per minute.

OPERATING PROCEDURE

The suction control panel, with vacuum and cylinder contents gauges, is located on the left of the cabinet, and the following operating sequence should be observed:

1. Open oxygen cylinder valve two complete turns with the key provided.
2. Place suction control (B) in the 'Off' position.
3. Open efficiency control (A) until maximum vacuum is shown on vacuum gauge.
4. Adjust efficiency control (A) to required operating vacuum.
5. Place suction control (B) in the 'On' position.

The unit is now ready for use and will operate at the degree of suction determined by the position of the efficiency control.
The suction bottle has no blow-off valve and care should be taken not to overfill.

'LINCOLN 800' CLOSED CIRCUIT UNIT

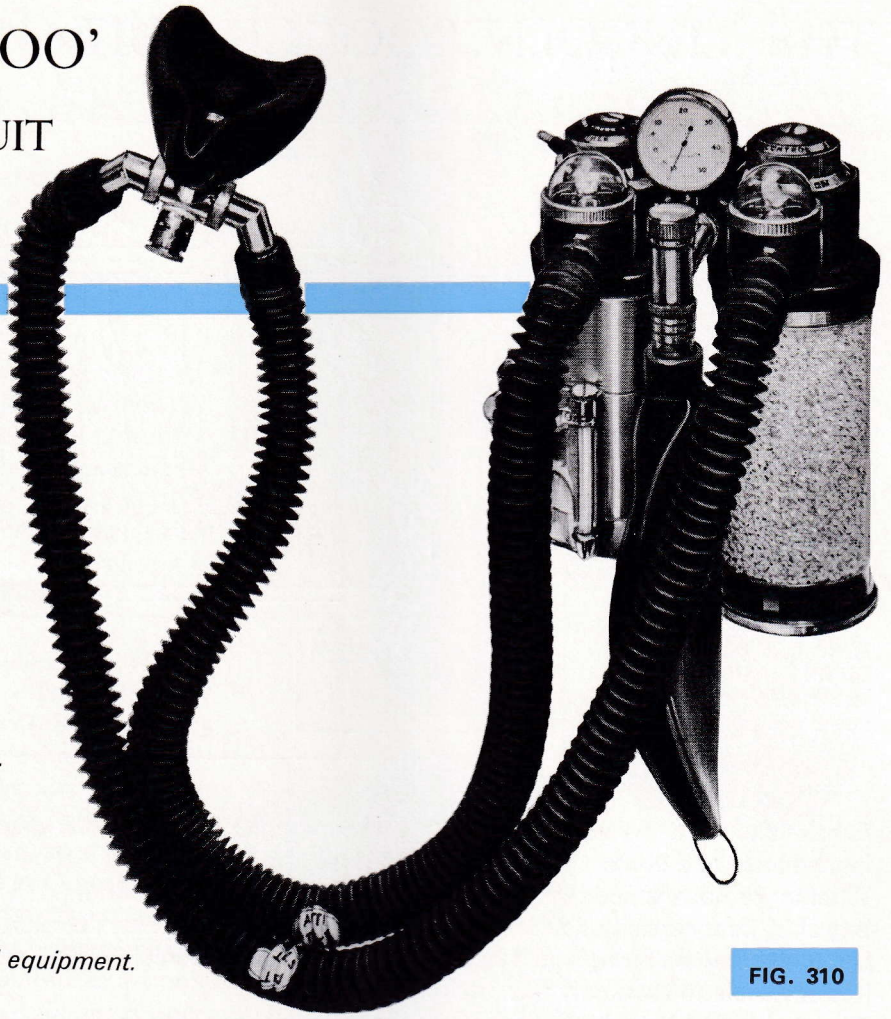


Illustration shows absorber with ether vaporiser and single soda-lime canister. This is alternative to the

TWIN SODA-LIME CANISTER MODEL

which is fitted as standard equipment.

FIG. 310

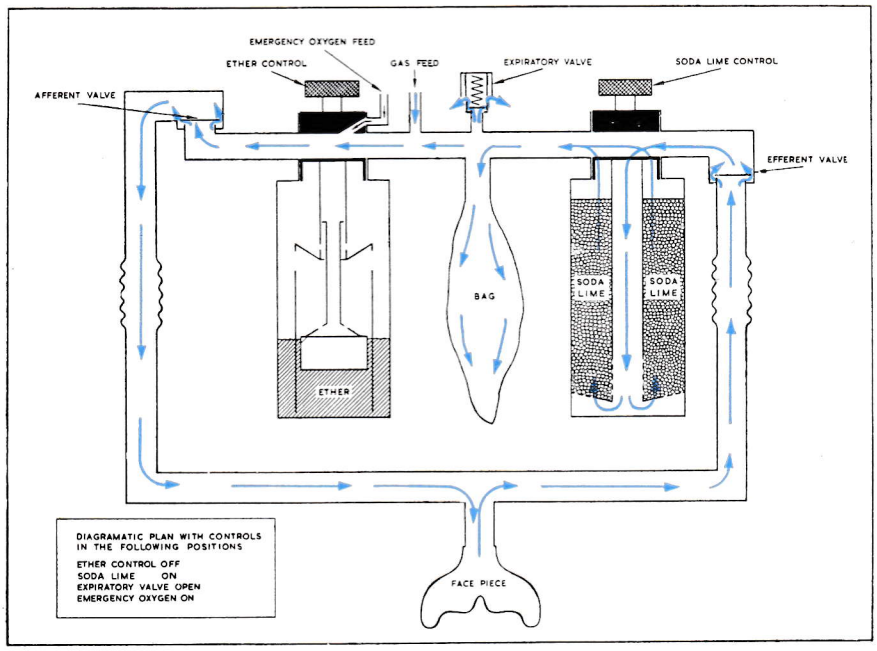
The 'LINCOLN 800' Unit for Closed Circuit Anaesthesia has been designed in an effort to incorporate, as far as possible, the desirable features which arise from the rapid advances made in anaesthesia over recent years.

The skill of the anaesthetist alone can produce a successful anaesthetic, but the designer can make that task a great deal easier in providing apparatus that will produce accuracy combined with simplicity and safety.

Light-weight materials have been used in producing a one-piece casting which forms the main body of the Absorber. Leakages are, therefore, eliminated. The large bore channels, together with uni-directional valves mounted within clear glass domes ensure extremely low resistance values.

Resistance values must, of course, at all times be associated with flow rates and other commonplace factors, but under predetermined conditions resistance values of slightly in excess of $\frac{1}{4}$ inch (6·35 mm) of water were obtained. These values showed no appreciable change when, under test conditions, the soda-lime was deliberately moistened.

THE 'LINCOLN 800' CIRCUIT



From this plan of the circuit, it is a simple matter to follow the sequence of exhaled gases.

Exhalations from the patient pass via the corrugated tubing to the entry of the absorber coming immediately into contact with the efferent directional valve.

Whether or not the soda-lime canister is in circuit, the gases continue their passage to the reservoir bag of $2\frac{1}{2}$ litres capacity. An extremely light expiratory valve of new design is located above the reservoir bag which can be brought into operation at will. If the absorber is fitted with two soda-lime canisters, it is advisable to have only one in circuit at a time.

The inspiratory phase draws gases from the reservoir bag via the afferent directional valve. These gases can be passed through the ether vaporiser or the second soda-lime canister, whichever is fitted. Fresh gases are entrained immediately after the reservoir bag.

A sensitive manometer, recording both positive and negative pressures, is placed conveniently on the body of the unit.

The reservoir bag is fitted with an extension piece enabling it to be brought within easy reach for manual compression.

ETHER VAPORISER (OPTIONAL)

Reasonably constant ether concentrations have always been demanded by the anaesthetist and a fair measure of success has been achieved by the employment of a new principle in ether vaporisation. A copper float similar to the carburettor type is anchored within a central tube which rides slightly above the level of the liquid. The capacity of the float in relation to the amount of liquid available in the vaporiser ensures that under all conditions the float remains almost submerged. A series of flutes surrounding the head of the float permit all incoming gases to splay above the ether surface.

With such an arrangement it will be seen that when the liquid level diminishes the float falls progressively with it so that all gases vaporise at the same level. Laboratory tests show that with a given flow rate against time, a progressional rise of ether concentration in relation to the control position is available.

THE EMERGENCY OXYGEN FLUSH CONTROL

ON THE 'LINCOLN 800'

The dangers associated with emergency direct oxygen are well known when by design the gas is forced to travel through a closed circuit system with an ether chamber in circuit. Invariably the anaesthetist is required to turn off all controls before direct oxygen can be administered, otherwise it is possible that contamination with ether vapour may result.

A unique feature of the 'LINCOLN 800' is the direct oxygen system which forms part of the ether control itself. Being spring loaded the ether control, when operated, will enable oxygen at a pressure of 5 lb per square inch (0·352 kg/cm²) and a flow of 36 litres per minute, to pass to the patient via the reservoir bag, and at the same time automatically turn the ether control to the 'off' position. Contaminated direct oxygen is therefore avoided by depressing a single control. On the twin canister unit the oxygen flush is fitted to the control of the second canister.

FIG. 310

THE 'LINCOLN 800' CLOSED CIRCUIT UNIT can be used in conjunction with any suitable anaesthetic apparatus and is complete with corrugated tubings and reservoir bag of anti-static quality.

All bright parts are chromium plated, and the main body is in black stove enamel. The streamlined form enables it to be cleaned easily.

The well tried Magill swivel 'Y' piece, with additional spring loaded expiratory valve completes the assembly. Dimensions throughout the unit comply with British Standard 3842 (1965).

REGULATORS

M.I.E. oxygen and nitrous oxide regulators are of the Universal type and are therefore suitable for use with cylinder or pipeline supply. No regulator is necessary for the cyclopropane cylinder which is fitted into a special yoke. Flows are controlled from the Rotameter Unit.
Fittings for connecting to pipeline supply are available as extras.
A special feature of the apparatus is the complete elimination of rubber for connecting purposes. All gas connections and feeds are constructed of chromium-plated copper tubing, leakages, therefore, are eliminated and servicing is reduced to a minimum.

ASSEMBLY INSTRUCTIONS

Ensuring that the washers are in position fit the three oxygen cylinders, the two nitrous oxide cylinders and one cyclopropane cylinder into the appropriate yokes and tighten the thumb screws. Tighten all cylinder nuts securely. A universal spanner is provided for this purpose. The pin index system yokes prevent the incorrect fitting of cylinders, and all yokes are engraved with coloured identifications, thus:

- **WHITE** .. .. Oxygen
- **BLUE** .. .. Nitrous Oxide
- **ORANGE** .. .. Cyclopropane
- **GREY** .. .. Carbon dioxide (when fitted)

Fit together Rotameter Bank and Gradoliser chloroform or ether Unit, also trichloroethylene safety by-pass control and Rowbotham Vaporiser by means of tapered outlets. Fit into the appropriate slots in the back bar of Table and secure by means of nuts fitted to rear of Rotameter Banks and Gradoliser Units, etc. If the semi-closed technique is to be employed, the Magill Reservoir Attachment is fitted into the Cardiff Swivel Attachment. The 'Lincoln 800' Closed Circuit Unit is then fitted to the adjustable upright assembly after first removing the knurled nut at the end of the upright. The Closed Circuit Unit is fitted with a small circular boss through which the upright should be inserted and secured by means of the knurled nut previously removed. Fresh gases are transmitted to the Closed Circuit Unit via the rubber lead which is fitted at the distal end with a nut and liner. The locating point will be found underneath the main shelf which is fitted with a dummy plug and chain. This is also the location point for the Waters 'To and Fro' Unit, should this technique be employed. The assembly is completed when the twin corrugated rubber tubing is fitted to the outlets of the absorber located beneath the directional valve covers.

SERVICING THE APPARATUS

It will be readily appreciated by the anaesthetist that servicing should be carried out only by our trained technicians, and details of a contract service scheme are available on request. We realise, however, particularly with overseas users that this is not always possible and for this reason we give below a summary of the servicing that should be carried out.

ROTAMETER BANK

It will be necessary to remove the Rotameter tubes from time to time for cleaning purposes. This is indicated when the bobbins fail to rotate or tend to stick in one position. The four caps are removed, together with the washers, and the tubes withdrawn. Clean the tubes and bobbins with a Rotameter brush and ether, taking care to see that not only the fins on the bobbins are clear of any particles of dust, but also the inside. This is very important. Do not wipe with a cloth as small particles of the material will impede the effectiveness of the bobbin. When replacing, make certain that the tubes are fitted in an upright position. This can be checked by passing gas through the system when the bobbins must at all times rotate freely.

GRADOLISER – ETHER OR CHLOROFORM

After some use the drums of these units will dry off and require to be re-greased. To do this, remove the Rotameter Bank and the ether/chloroform Unit after first releasing the hexagonal nuts at the rear of each Unit. Unscrew the controls and withdraw the drum carefully with the forefinger. Re-lubricate with ether-resistant grease and replace. Remove plunger by means of the small knurled nut, re-grease packing with special lubricant and replace.

TRICHLOROETHYLENE SAFETY BY-PASS CONTROL

The above Unit is attached to the apparatus by means of a locking nut. Remove this and the by-pass control will slide out of position. To lubricate the drum, first remove the control lever, withdraw the drum carefully with the forefinger, grease and replace.

'LINCOLN 800' CLOSED CIRCUIT UNIT

In order to check the system for possible leakages, close the two outlets and both expiratory valves, and pass a flow of gas into the system until the reservoir bag is fully extended. Manual compression of the reservoir bag will now detect any leakages which can be readily corrected; care should be taken to avoid damaging the manometer by using excessive pressure.
The directional valves will require cleaning and drying after each case. They are easily removed after first removing the two outer domes. Care should be taken not to impair the flat ground surfaces of the knife-edge seating on which they rest.

The ether and absorption controls should be removed, cleaned and lubricated from time to time. They should be removed in the following sequence.
Remove three screws holding control scale in position. Loosen large screw in centre of control knob, this will permit both scale and control knob to be removed. The drum can be released when the three holding screws are removed. These can be located underneath the body of the absorber when both the ether container and transparent canister are removed. Care should be taken that the drums are correctly positioned when replaced. This can be ascertained by passing gas into the system and the control drums are correctly assembled only when gas can be heard passing through the central port.

REGULATORS (Low Pressure) UNIVERSAL

After a considerable period, the rubber bellows fitted to the Regulators may need replacing. This may be determined if an escape of gas is heard through the escape holes located round the outer case of each Regulator. A service exchange system is operated for the convenience of our customers.

BRIEF METHOD OF OPERATION

Fluid agents are added to the vaporiser bottles as required and a charge of soda-lime placed in the canister if the absorption method is to be employed. The cylinders, which have previously been connected to the apparatus, are then turned on and the Rotameter controls checked to see that maximum flows are available on all gases.
Assuming that it is desired to use the Magill Reservoir Attachment to anaesthetise a patient with gas, oxygen and ether, the Trichloroethylene safety by-pass must be in the 'open circuit' position. Suitable flows of gas and oxygen are turned on and the mask applied to the patient's face. The mask may be secured to the face with a harness designed for this purpose. The introduction of ether to the system can be made very gradually by judicious use of the double control. The control lever deflects more or less of the gases through the bottle, and the plunger further modifies the concentration of ether by causing the gases either to blow over or bubble through the ether.
The expiratory valve 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 is connected by selecting the 'Absorber' position on the safety by-pass. When the canister 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 Absorber.
Suitable gas flows are turned on, and the mask applied to the patient's face as in the semi-closed technique outlined above. An airtight fit at the mask is essential and it will be found that the Magill Soda-Lime Connector is of 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 Closed Circuit Unit and the other on the Magill Soda-Lime Connector. The Absorber Control should be turned on when the circuit is closed to avoid an accumulation of carbon dioxide. Most anaesthetists do not use intermediary positions of the Absorber Control, having it turned 'full on' or 'off'.
Gas flows are now readjusted. A basic flow of oxygen will be required throughout the anaesthetic to replace that metabolised. Other agents are added until a sufficient depth of anaesthesia can be maintained.
The foregoing gives an outline of the mode of operation. It will, of course, be appreciated that no instructions of this type can replace experience gained by working with the apparatus under the guidance of a skilled anaesthetist.

THE WIMPOLE (BOYLE TYPE) APPARATUS FOR GENERAL ANAESTHESIA

The WIMPOLE Unit has been designed for the administration of oxygen, nitrous oxide, cyclopropane, chloroform, trichloroethylene and ether with closed circuit anaesthesia. Suction and Mercurial Sphygmomanometer Blood Pressure Units are fitted as standard.
The controls are easily accessible, it is of simple design and robust construction to give long and trouble-free service in the busy theatre of a large hospital.
Provision is made for three gas cylinders on each side of the unit:

LEFT	RIGHT
3×24 cu. ft oxygen	2×200 (or 2×400) gals nitrous oxide
	1×50 gals cyclopropane

All cylinder yokes are designed to accommodate the pin-index system flush-type cylinder valve, and are of the gate type.

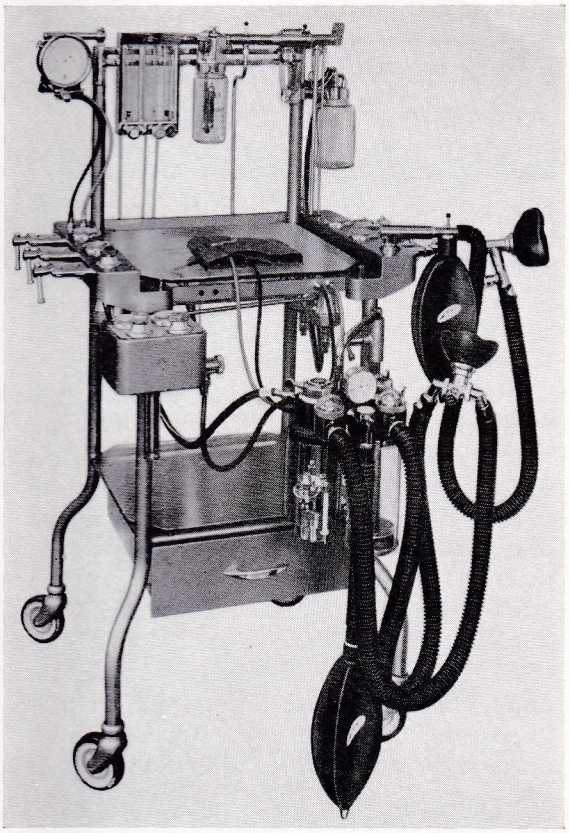


FIG. 1

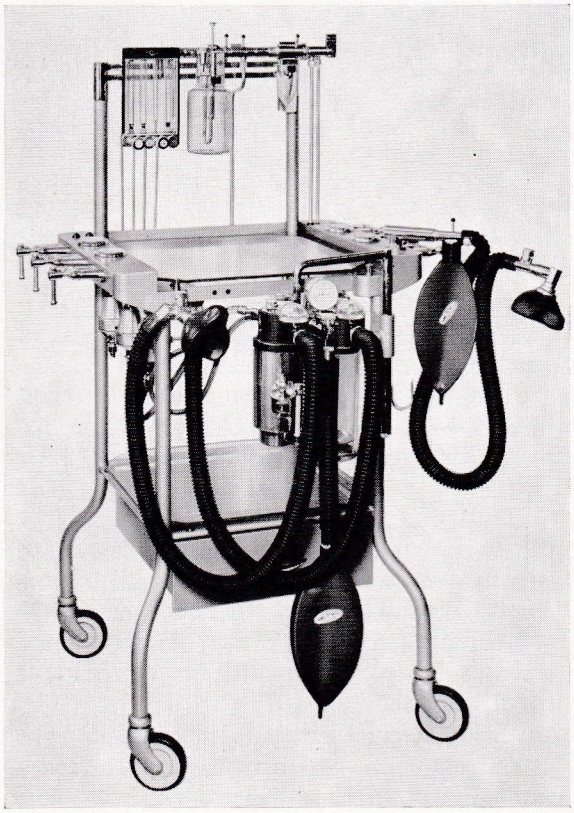


FIG. 6

THE WEYMOUTH (BOYLE TYPE) APPARATUS FOR GENERAL ANAESTHESIA

The general specification for the WEYMOUTH Apparatus for General Anaesthesia is precisely the same as for the WIMPOLE Unit, except that, as the illustration shows, no provision is made for the Injector Suction or Blood Pressure Units, but provision for the administration of carbon dioxide is fitted as standard.

LEFT	RIGHT
2×24 cu. ft oxygen	2×200 (or 2×400) gals nitrous oxide
1×2 lb carbon dioxide	1×50 gals cyclopropane

A special feature of both the WIMPOLE and the WEYMOUTH Units is the complete elimination of rubber for connecting purposes. All gas connections and feeds are constructed of copper tubing. Leakages, therefore, are obviated, and servicing is reduced to a minimum.

Both the WIMPOLE and WEYMOUTH Units can be modified to suit customers' own requirements.

THE HARLEY (BOYLE TYPE) PORTABLE APPARATUS FOR GENERAL ANAESTHESIA

Designed to provide a self-contained portable unit at a moderate price and capable of fulfilling all the requirements for general anaesthesia. The HARLEY Unit (Fig. 10) comprises two transportable sections – the Head – and the Stand Assembly.

A four-block Rotameter unit illustrated below provides for the administration of oxygen, nitrous oxide, cyclopropane and carbon di-oxide. Fine adjustment control valves for oxygen, nitrous oxide and carbon dioxide are incorporated in the unit. The cyclopropane control valve is fitted to the cyclopropane cylinder yoke on the stand assembly.

Provision is made for vaporisation of ether or trichloroethylene via the Boyle type gradoliser on the Rotameter assembly. By-pass controls for oxygen and nitrous oxide enable direct flows to be administered. The Rotameter is available without N_2O by-pass if required.

The M.I.E. Closed Circuit Unit, as described on page twelve, is fitted as standard. A Magill Reservoir assembly is available as an optional extra to provide for the semi-closed technique.

Suitable yokes enable 2×36 or 72 gallon oxygen cylinders, 2×100 or 200 gallon nitrous oxide cylinders, and 25 or 50 gallon cyclopropane cylinders to be fitted.

Low pressure reducing valves for oxygen and nitrous oxide are located below the main yoke casting to permit the reduction of cylinder pressures to approximately 5 lb per square inch (0·352 kg/cm²).

Four anti-static gas supply leads are fitted permanently to the yoke casting with non-interchangeable type connections, and when these are fitted to the appropriate inlets at the rear of the Rotameter unit, the apparatus is ready for use.

A heavy quality cover is provided for the stand assembly, and a carrying case to accommodate the head and accessories.

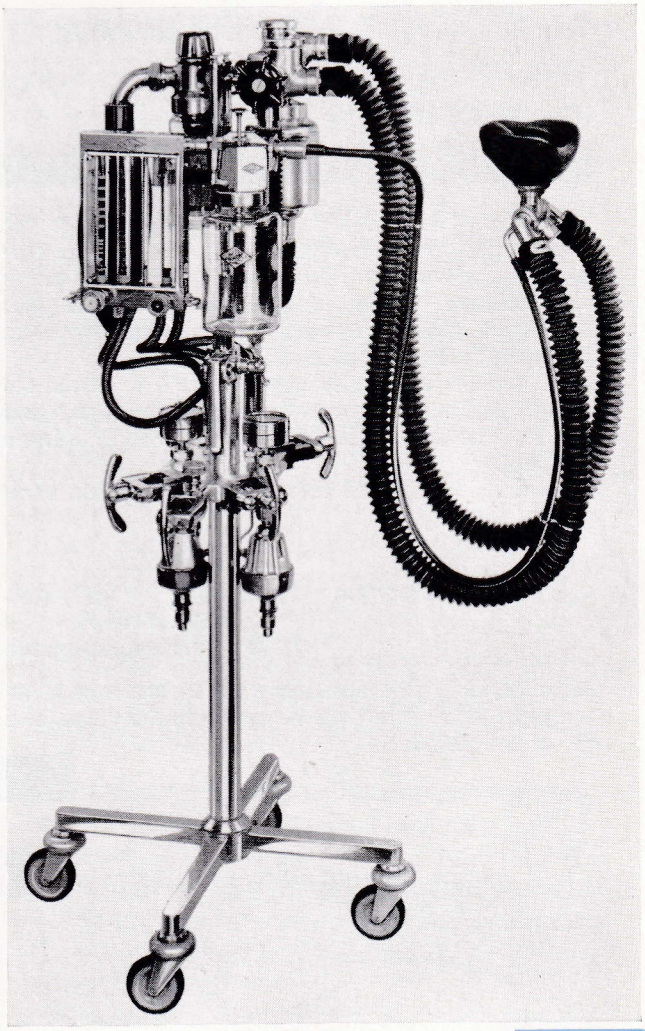


FIG. 10

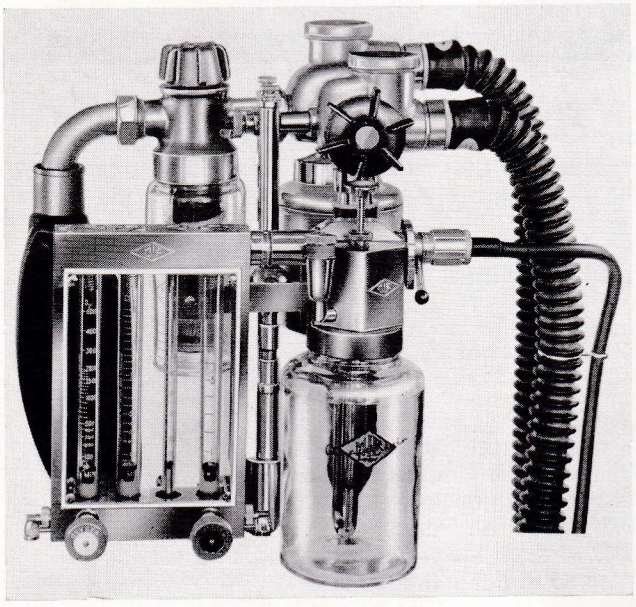


FIG. 11

THE SALISBURY

GAS-OXYGEN-HALOTHANE APPARATUS FOR DENTAL ANAESTHESIA

The design features of the Salisbury Gas-Oxygen-Halothane apparatus closely follow the pattern widely used today in hospitals throughout the world. The introduction of the Salisbury Unit brings the most up-to-date technique within the scope of dental practice.

Predetermined pressure and percentage devices, so often inaccurate, have been abandoned in favour of Rotameters, a principle on which most anaesthetists are trained. A Temperature Compensated Vaporiser for the administration of Halothane as an inhalational supplement is fitted to the outlet of the Rotameter bank. The Halothane Vaporiser is actuated by a thermostat which ensures that over a temperature range of 40° – 100°F (4° – 38° C) a consistent concentration throughout the entire range of flow is made possible. A reservoir bag of 2 litres capacity is fitted with an appropriate mount to the outlet of the Vaporiser from which the gas mixture is inspired by the patient. The reservoir bag is always in circuit. It has no 'off' control and when this technique is employed re-breathing does not take place. The gas mixture continues to the patient via a flexible rubber tube to which is fitted the Magill spring-loaded expiratory valve. This valve should be fully open at all times to enable free exhalation to take place.

A face-piece angle mount, and size 4 face-piece completes the assembly. Smaller size face-pieces are available on request. If it is desirable to administer by the conventional nose-piece the Goldman nylon pattern is supplied as standard with the appropriate harness. No mouth cover is supplied. The male and female mounts fitted to the apparatus are fully interchangeable and ensure rapidity of change from mask to nose-piece. Apart from the flexible tubing, reservoir bag and mask, all rubber has been eliminated and replaced with chromium-plated copper tubing thus avoiding possible leaks in the gas circuit.

Whilst any percentage of nitrous oxide can be administered by the Rotameter control unit the technique advised is a proportion of 75 per cent nitrous oxide and 25 per cent oxygen. These percentages are easily established at varying flow rates by reference to the scale between the Rotameter tubes. Two fine adjustment controls are provided to actuate the flow of gases which are adjusted until each flow corresponds to the calibration mark on the scale, or as desired by the anaesthetist. When adjusted to the desired flow the gas mixture will flow continuously to the patient, it is not an intermittent action. The suggested flow rates indicated on the scale are, for adults – 6 litres of nitrous oxide and 2 litres of oxygen, and for children – $4\frac{1}{2}$ litres of nitrous oxide and $1\frac{1}{2}$ litres oxygen.

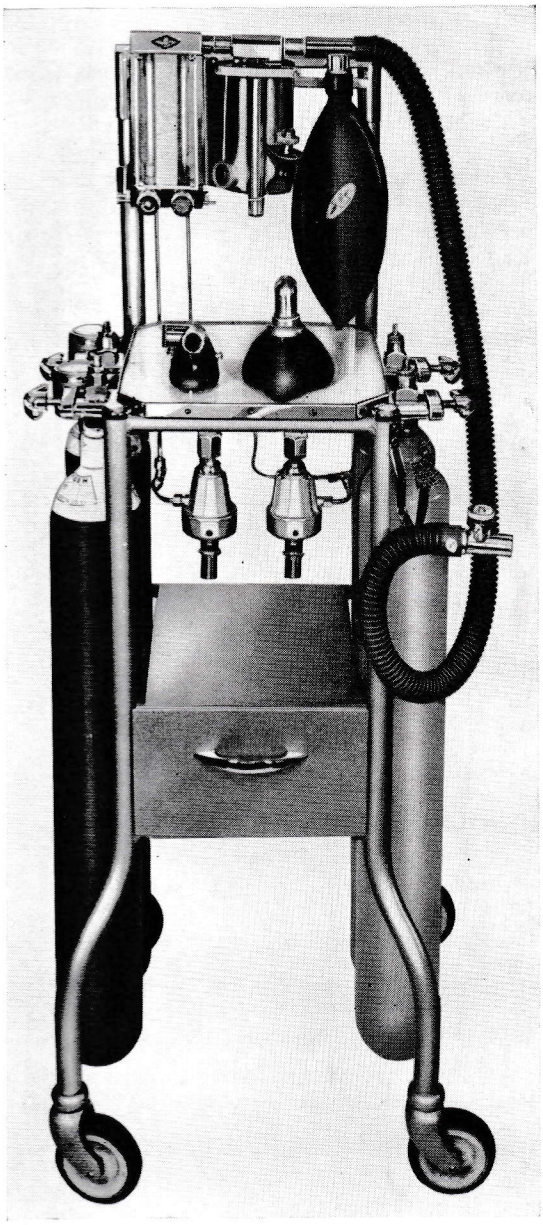


FIG. 60

Both gases are fed into the rear of the Rotameter control unit via copper tubing assemblies from pre-set reducing valves at 5 lb per square inch (0·352 kg/cm²).

An oxygen by-pass lever which will deliver a flow of 20 litres of pure oxygen is available for use in an emergency. It will be appreciated, however, that the nitrous oxide and Halothane units must be turned off when the oxygen by-pass is in use.

The Halothane Vapour is conveyed to the patient by the flow of nitrous oxide and oxygen. The Vaporiser should be switched to the 'off' position when anaesthesia has been established otherwise recovery may be retarded. The capacity of the Vaporiser is 110 cc., the stabilising wicks absorb a further 60 cc., the contents of the chamber can be observed through the sight glass after filling through the removable filler located in the front of the unit. A drain plug which is fitted at the base of the Vaporiser allows the removal of Halothane after use.

As an optional extra a pulse indicator – invaluable as a guide to the suspect cardiac patient – is available. It enables an extremely efficient photo cell unit to detect a change in cardiac action that might occur during anaesthesia.

CASUALTY
AND OUT-PATIENTS ANAESTHETIC UNIT

This unit is designed primarily for the casualty and out-patients theatre as a compact mobile apparatus for gas-oxygen ether and trichloroethylene anaesthesia.

The M.I.E. CASUALTY Unit comprises a three-tube Rotameter bank for N_2O, O_2 and CO_2 gases, plunger type ether vaporiser and Magill Reservoir Attachment, mounted on a light but robust stand fitted with anti-static ball-bearing castors.

The M.I.E. Circle Absorber can be readily attached, and equipment for cyclopropane anaesthesia can be supplied if required.

Halothane and 'Trilene' Temperature Compensated Vaporisers can be fitted as alternatives.

FIG. 9

THE ENDERBY PORTABLE ANAESTHETIC UNIT

(MARK II)

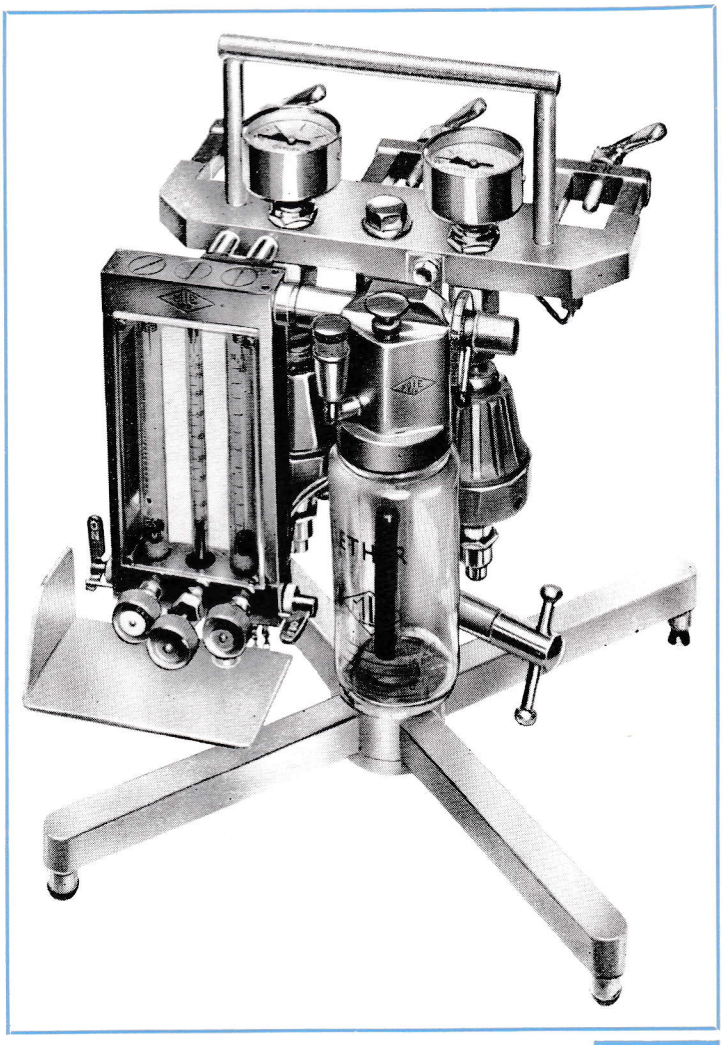


FIG. 17

Redesigned to accommodate recent advances, this popular unit comprises a Rotameter bank for the accurate administration of oxygen, nitrous oxide and cyclopropane. By-pass controls for oxygen and nitrous oxide and a Boyle type ether unit are fitted as standard.

The Yoke assembly and stand are in anodised aluminium. The use of a unique locking device enables the assembly to be raised to accommodate 1 × 72 gal. oxygen and 1 × 200 gal. nitrous oxide lightweight cylinders. In the lower position, 18 or 36 gal. oxygen and 50 or 100 gal. nitrous oxide cylinders are accommodated in yokes which will accept only the Pin Index type cylinder rendering interchangeability of gas cylinders impossible.

The cyclopropane yoke, also of Pin Index pattern, is placed centrally and accommodates either a 25 or a 50 gal. cylinder.

For the benefit of our overseas customers, adaptors are fitted to the yokes which can be removed to accommodate the type 7 gas cylinders.

Reduction of cylinder pressures for nitrous oxide and oxygen is carried out via the low pressure reducing valves fitted beneath each yoke, and chromium-plated copper gas feed tubing ensures a leak-proof and permanent system. Should it be desired to use a larger type of nitrous oxide or oxygen cylinder as an independent source of supply, provision is made for this by removing the small plug mounts located at the base of the Rotameter unit, and fitting gas supply tubings from the independent sources of supply at this point. It is emphasized that such independent sources of supply must be fitted with the appropriate reducing valves. The necessary tubing and connections are supplied as standard, but the reducing valves are available as an extra.

Gauges for both nitrous oxide and oxygen are fitted at the head of the unit and provide an indication of the cylinder contents at a glance. A 1 lb (454 g) capacity Waters to-and-fro canister is provided with the apparatus which enables induction of anaesthesia to be carried out by employing initially the unit less the canister, the canister being introduced into the circuit at the appropriate time and the expiratory valve adjusted, if necessary.

An extension piece is provided to enable the reservoir bag to be used in a remote position.

A combined cylinder key and spanner and plastic protective cover completes the standard assembly.

A small carrying case is provided to accommodate the Waters canister assembly.