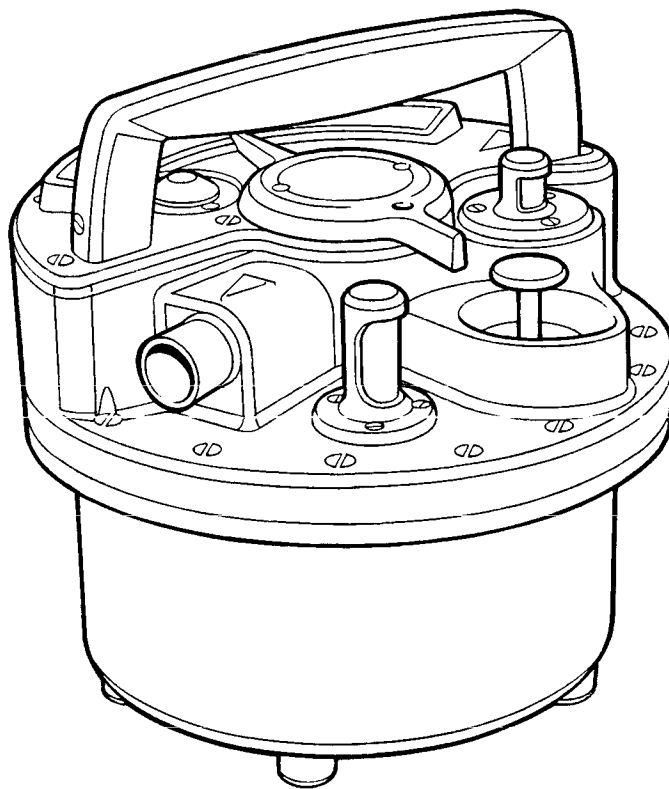


Service Manual

for

EMO Outfit and EMO Ether Inhaler



Penlon Ltd
Abingdon
OX14 3PH
UK
Tel: 44 1235 547076
Fax: 44 1235 547062
E-mail: technicalsupport@penlon.co.uk

IMPORTANT

Servicing and Repairs

In order to ensure the full operational life of this device, servicing by a **Penlon-trained engineer** should be undertaken periodically.

The ventilator must be serviced to the schedule in this manual.

For any enquiry regarding the servicing or repair of this product, contact the nearest accredited Penlon agent:

or communicate directly with:

Technical Support
Penlon Limited
Abingdon Science Park
Barton Lane
Abingdon
OX14 3PH
UK

Tel: +44 (0) 1235 547076
Fax: +44 (0) 1235 547062
E-mail: technical.support@penlon.co.uk

Always give as much of the following information as possible:

1. Type of equipment
2. Product name
3. Serial number
4. Approximate date of purchase
5. Apparent fault

FOREWORD

This manual has been produced to provide authorized personnel with information on the function, routine performance and maintenance checks/servicing and repair, applicable to the Penlon EMO Outfit.

Information contained in the manual is correct at the date of publication. The policy of Penlon Ltd. is one of continued improvement to its products. Because of this policy Penlon Ltd. reserves the right to make any changes, which may affect instructions in this manual, without giving prior notice.

Personnel must make themselves familiar with the contents of this manual before servicing or repairing the EMO Outfit.

Copyright © Penlon Ltd., 1998. All Rights Reserved.

E.M.O. ETHER INHALER – USER'S SERVICING INSTRUCTIONS

(These tests are repeated in the Instruction Booklet – page 21)

The E.M.O. Inhaler is very simple to use and very robust. Only a minimum of servicing is required, but in order to obtain completely satisfactory service a few points require regular attention.

SERVICING INSTRUCTIONS

The E.M.O. Inhaler has only two moving components, the concentration rotor and the temperature compensator. Before leaving the factory these components are very accurately adjusted and the adjustment must not be altered under any circumstances, nor must any attempt be made to lubricate any part.

To ensure that the apparatus is always in perfect working order the following simple tests should be carried out periodically. It is important to employ these tests if the inhaler has been stored for any length of time out of use.

(a) LEVEL INDICATOR

With the ether compartment or container empty, slowly invert the inhaler and check that the indicator falls freely to the 'Full' position and likewise returns to the 'Empty' position when the inhaler is returned to the upright position. When refilling, check that the quantity of ether agrees approximately with the figures given on Page 20 of the Instruction Booklet.

(b) CLOSING MECHANISM

Turn the Control Knob to the transit position and connect the outlet of the Oxford Inflating Bellows or other ventilating equipment to the inlet of the inhaler. Block the outlet of the E.M.O., apply gentle pressure to the Bellows Unit, and open the ether filler. There should be no escape of air through the filler, or through the top of the closing mechanism.

(c) FILLER

With the bellows still connected to the inlet of the inhaler and the outlet blocked, open the Control Knob to '10'. Apply gentle pressure to the Bellows and note that there should be no leakage through the filler.

(d) SAFETY RELEASE VALVE

(This is combined in the Closing Mechanism Unit)

With the Control Knob set at '12' and the Oxford Bellows connected in the normal position on the outlet of the E.M.O. Inhaler, block the inlet to the inhaler and check that operation of the Bellows draws in air through the safety valve.

(e) TEMPERATURE COMPENSATING UNIT

The position of the temperature compensating indicator will show whether the unit is in satisfactory working order. The indicator consists of a rod with a black and red band and a metal top. At normal room temperature (20 – 25°C) the metal top and black band should be visible; at temperatures above 32°C the red band will begin to show. If only the metal can be seen at 20 – 25°C the unit is faulty and should be replaced.

(f) WATER COMPARTMENT

If the water used to fill the water compartment is suspected to contain high concentration of salts or chlorine, it is advisable to empty and refill this compartment from time to time.

In the event of difficulties in service, or shown by these tests, follow the instructions given in the following pages.

The foregoing notes provide sufficient information for the user to obtain the best possible service from the E.M.O. Inhaler.

It must be stressed that only pure ether should be used in the ether E.M.O. Inhaler, as any other drug may cause serious corrosion difficulties.

CLEANING AND STERILISING

No antiseptic solutions must be used to clean the inhaler. The exterior may be cleaned by wiping over with a cloth damped in ether when necessary.

Sterilising is not normally necessary as the inhaler is used on open circuit, protected from contamination by non-return valves. If special circumstances make it necessary to sterilise, the only suitable method is the use of Ethylene Dioxide gas. Excessive heat, due to boiling or autoclaving would render the inhaler useless.

FAULT FINDING – RECTIFICATION

The notes given overleaf are for the guidance of users and agents carrying out servicing. The user is recommended to replace defective units in all cases. These are readily available from the manufacturer or from principal agents, some on a 'service exchange' basis.

When ordering spare units the serial number of the inhaler should always be quoted, and the defective part returned with the order if possible.

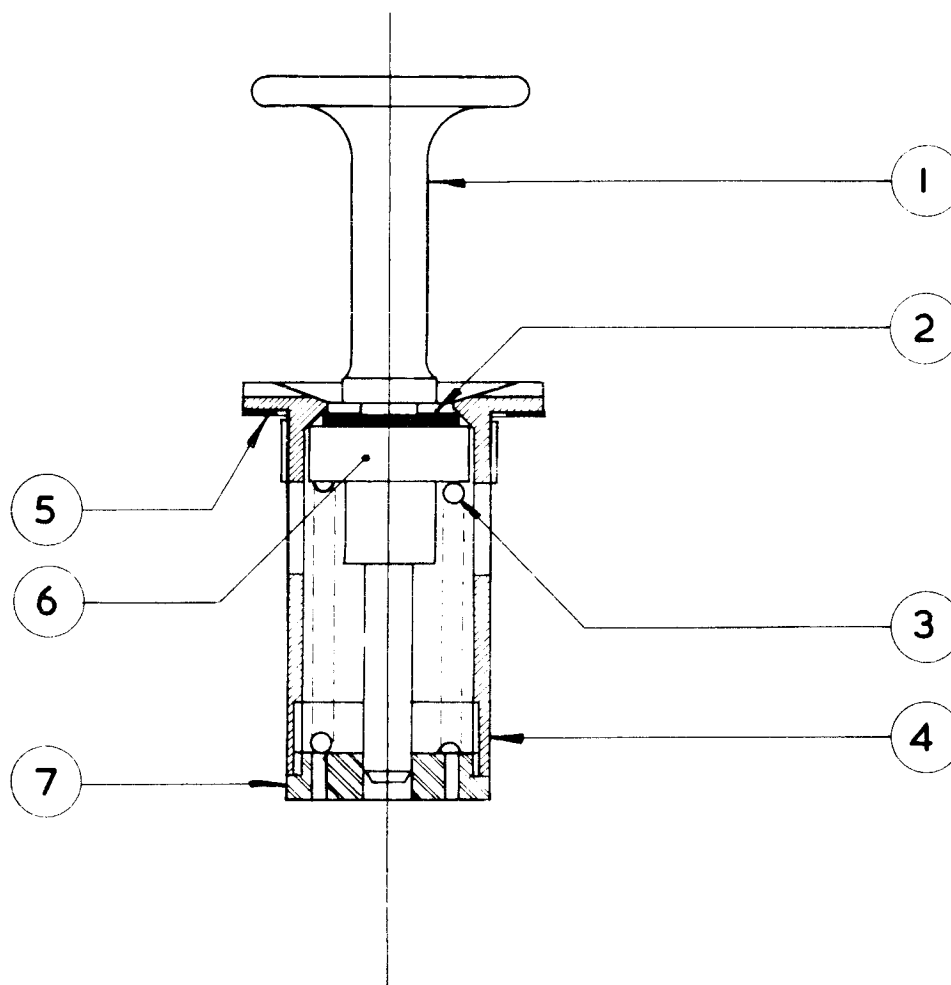
e.g. To order a new level indicator for an ether E.M.O. specify part number 60600 for inhaler No.

LIST OF TOOLS AVAILABLE FOR E.M.O. INHALER SERVICE

No.	Purpose
E.M.O. 1	Special Screwdriver for removing filling unit for inhaler.
E.M.O. 2	Rotor removal tool.
E.M.O. 4	Gauge for rotor setting of inhaler.
E.M.O. 5	Extractor for spring dowels in centre of control pointer assembly.
E.M.O. 6	Hexagon key for removing 'Allen' screw in lid.
E.M.O. 7	Hexagon key for adjusting 'Allen' screws on pointer boss.
E.M.O. 8	Box spanner for lock nut 5/16 B.S.F.

FAULT	CAUSE	RECTIFICATION BY USER	RECTIFICATION BY SERVICE ENGINEER
<p>CONCENTRATION CONTROL seized</p> <p>ETHER ESCAPING although control is in "closed for transit" position</p> <p>CONCENTRATIONS appear to be HIGHER than normal initially but drop rapidly during use</p> <p>CONCENTRATIONS appear to be LOWER than normal</p>	<p>Rotor seized</p> <p>(a) Broken level indicator glass</p> <p>(b) Broken indicator glass on Temperature Compensator</p> <p>(c) Closing mechanism not shutting</p> <p>(a) Temperature Compensator not operating</p> <p>(b) Filler left open (Mk. I)</p> <p>(a) Leak in circuit</p> <p>(b) Relief valve on closing mechanism stuck open</p>	<p>Return to Service Engineer</p> <p>(a) Replace level indicator unit. (See page 2.6)</p> <p>(b) Replace Temperature Compensator unit. Mk. I & II. (See page 2.9)</p> <p>(c) Replace closing mechanism unit. (See page 2.10)</p> <p>(a) Carry out test (e) see page 1.1, and if unit is defective replace by service unit. (See page 2.9)</p> <p>(b) Close Filler</p> <p>(a) Find and rectify</p> <p>(b) Carry out test (d) page 1.1 Replace closing mechanism unit if necessary. (See page 2.10)</p>	<p>See page 2.17</p> <p>(a) Fit new top assembly with glass (See page 2.6)</p> <p>(b) Fit new top assembly with glass (See pages 2.9 and 2.8)</p> <p>(c) (See page 2.10)</p> <p>(a) Carry out test (e) page 1.1, and if unit is defective replace by service unit. (See page 2.9)</p> <p>(b) Close Filler</p> <p>(a) Find and rectify</p> <p>(b) Carry out test (d) page 1.1. Replace closing mechanism unit if necessary. (See page 2.10) or fit new relief valve washer. (See page 2.10)</p>

FAULT	CAUSE	RECTIFICATION BY USER	RECTIFICATION BY SERVICE ENGINEER
<p>CONCENTRATIONS appear to be LOWER than normal</p> <p>LEVEL INDICATOR fails to rise when ether is added, but moves freely when inhaler is inverted</p> <p>LEVEL INDICATOR sticks at any point and will not move when inhaler is inverted</p>	<p>(c) Temperature Compensator not operating</p> <p>Broken float</p> <p>(a) Float caught by frayed wick</p> <p>(b) Caught by collapsed ether compartment due to gas build-up in water jacket owing to use of impure water</p>	<p>(c) Carry out test (e) see page 1.1. Replace if defective. (See page 2.9)</p> <p>Fit service level indicator unit. (See page 2.6)</p> <p>(a) Remove unit, cut away frayed ends of wicks with scissors</p> <p>(b) Return to makers or agent for servicing</p>	<p>(c) Carry out test (e) see page 1.1. Replace if defective. (See page 2.9)</p> <p>Replace float and wire assembly. (See page 2.6)</p> <p>(a) Remove unit, cut away frayed ends of wicks with scissors</p> <p>(b) Replace ether compartment. (See page 2.20)</p>



Key to Drawing Sheet 2.4

See Text Page 2.5

1 — Knob Part No. 60501	3 — Spring Part No. 60512
2 — Seal Part No. 60504	4 — Body Part No. 60519
5 — Gasket Part No. 60517	7 — Base Plug Part No. 60510
6 — Plunger Part No. 60518	Filler Unit Complete Part No. 60500

Note:— Item 5 Gasket 60517 is the only spare part available.

Other defects require the replacement of the complete filler unit 60500.

FILLER UNIT

FILLER

Retained in inhaler by screw thread. Special split screw-driver necessary for removal.

Please order Tool No. E.M.O.1.

Replacement Unit. Please order part No. 60500.

SPARES

Item 5 Gasket	60517
---------------	-------

LEVEL INDICATOR

Retained on Inhaler by 3 screws Part No. 0105.

Replacement Unit

60600

SPARES

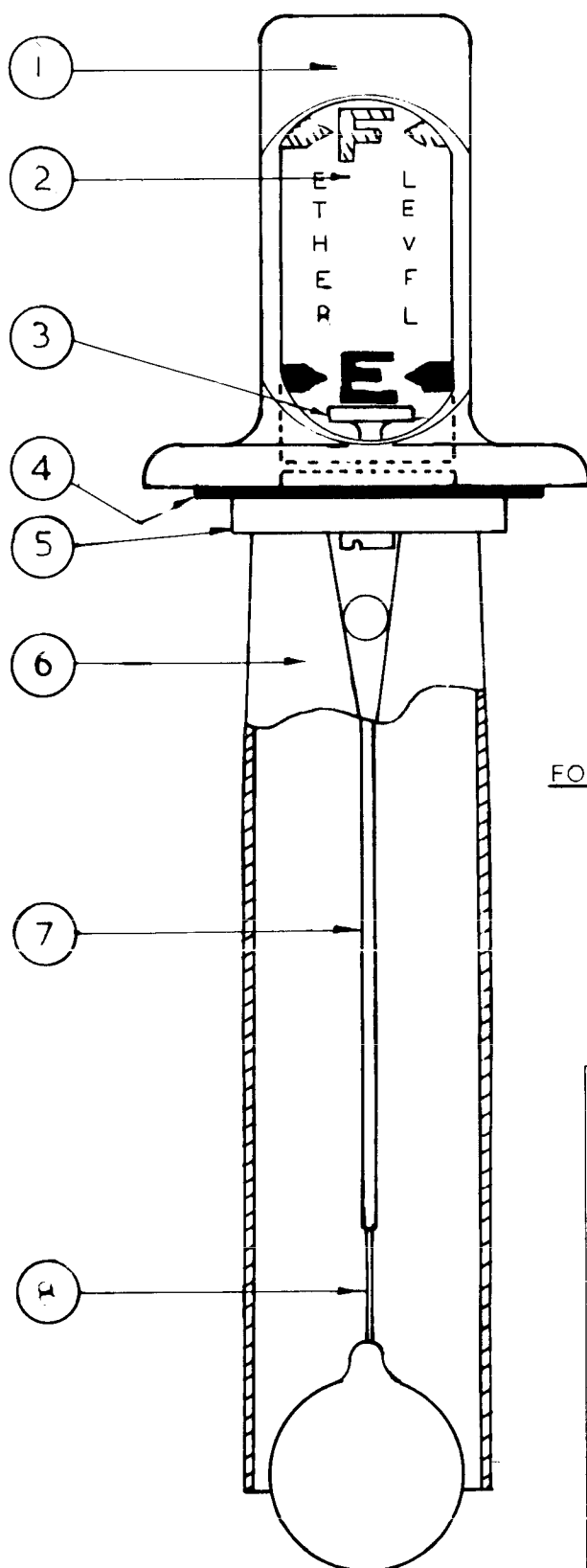
Item 1 & 2	Top assembly with glass.	60601/12
Item 3 & 7	Indicator and pole assy.	60608
Item 4	Gasket.	60616
Item 5	Screw.	0145
Item 6	Case Assembly.	60604
Item 8	Glass float with wire.	60613

New Glasses are not supplied separately as this item is sealed into the metal top with a special cement.

TO FIT A NEW GLASS FLOAT

The wire on the glass float is crimped into the tubular No. 7. To release the old wire, squeeze the tube across the direction of crimping and pull the wire out with a straight pull.

Insert the wire on the new float, and crimp the tube lightly with pliers. Fit the level indicator assembly into the empty E.M.O. Inhaler and check the position of the indicator when the float is resting on the bottom of the ether chamber. Adjust so the indicator is level with the two arrows on either side of 'E' by pulling or pushing the float as required. When the position is satisfactory, crimp the tube in a second place more heavily to secure the float wire.



FOR SETTING SEE INSTRUCTIONS

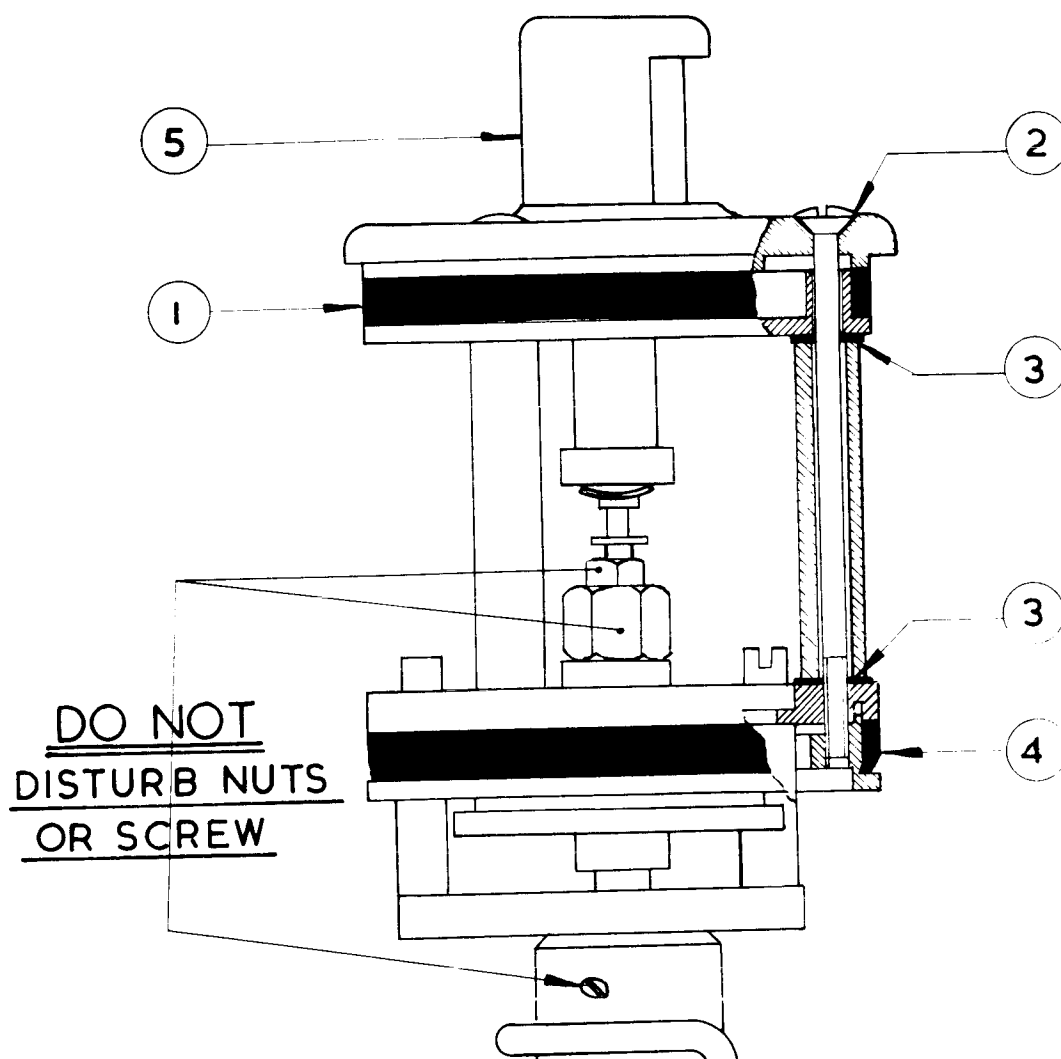
Key to Drawing Sheet 2.7

See Text Page 2.6

- 1 — Top with glass
Part No. 60601/12
- 2 —
- 3 — Indicator flag and pole
Supplied assembled to item 7 Part No. 60608
- 4 — Gasket
Part No. 60616
- 5 — Screw
Part No. 0145
- 6 — Cage Assembly
Part No. 60604
- 7 — Indicator flag and pole
(see 3 above)
- 8 — Float and wire assembly
Part No. 60613

Level Indicator Complete
Part No. 60600

LEVEL INDICATOR



Key to Drawing Sheet 2.8

See Text Page 2.9

- | | |
|---|--|
| 5 | — Indicator top with glass
Part No. 61666 & 61668 |
| 2 | — Nylon Washer
Part No. 60906 |
| 1 | — Upper Seal
Part No. 61647 or 0518
(see text) |
| 3 | — Nylon Washer
Part No. 60906 |
| 4 | — Lower Seal
Part No. 61658 or 0518
(see text) |
| Temperature Compensating Unit Mk. I-II Complete
Part No. 61601 | |

Note:— Service exchange unit 61601 should be used whenever tests indicate a malfunction of the unit.
This component should be replaced at 5 years intervals as preventive maintenance.

TEMPERATURE COMPENSATOR UNIT FOR MK. I & 2 E.M.O. INHALER

TEMPERATURE COMPENSATING UNIT

Replacement Unit. Please specify Serial No. of Inhaler marked on plate on back of body and order No. 61601

Retained in inhaler by 3 screws which expand rubber sealing sleeves when tightened. To remove assembly from inhaler slacken all three screws by 3—4 turns. Tap heads of screws down flush with plastic or wood block. Grip top of unit and twist or wriggle slightly to break grip of rubber seals. The unit should then lift out.

It may be necessary to repeat the slackening of the screws and tapping process if the inhaler has been in use for some time. DO NOT REMOVE THE SCREWS COMPLETELY as parts may be lost inside the inhaler.

TO FIT NEW UNIT

Make sure that the well in the inhaler body is clean, slacken 3 screws, and slide the unit in the inhaler body. Check that the top plate is fitting correctly to the inhaler without gaps and tighten screws.

NOTE:— If this unit is removed for any reason, it is desirable to fit new rubber seals before refitting to the inhaler.

These are available as:

Lower sealing ring

Upper sealing ring

Nylon washers for screw heads

Part Number 61658

Part Number 61647

Part Number 60906

E.M.O. Inhalers made after January 1968, serial numbers 7100 upwards, have O-ring seals replacing the Lower sealing ring and Upper sealing ring.

O-ring seal

Part Number 0518

CLOSING MECHANISM

Retained in Inhaler by two dogs operated by screws (marked A on drawing). To release the unit, unscrew these screws by 2 or 3 turns only, tap top of unit lightly with wood or plastic to break grip of sealing washer. A further turn on each screw should then release the dogs and the unit can be lifted out complete. To reassemble the closing mechanism to the inhaler, make sure that the dogs are turned fully in and insert unit in its seating, checking that the tongue provided on the inhaler fits into the slot in the closing mechanism body.

Tighten the two screws by one turn, lift unit to check that both dogs are engaged and then tighten screws fully.

Replacement Unit. Please order Part No. 60900.

Spare Parts

Item 1 — Body sealing washer	60923
Item 2 — Relief Valve washer	60924
Item 3 — Valve Assembly	60930
Item 4 — Split pin	092

TO FIT NEW VALVE ASSEMBLY

Remove split pin 4 and small washer. Discard split pin. Using fine pliers disengage the spring wire 6 from the hole in the valve stem. Remove complete valve stem assembly and fit new unit by reversing the above procedure. Use new split pin.

TO FIT NEW RELIEF WASHER

Pull down spring 8 and hold the spindle 7 inside it. By pressing the spindle away from the closing mechanism body the top end can be disengaged and the washer is then readily replaced.

TO FIT NEW BODY SEALING WASHER

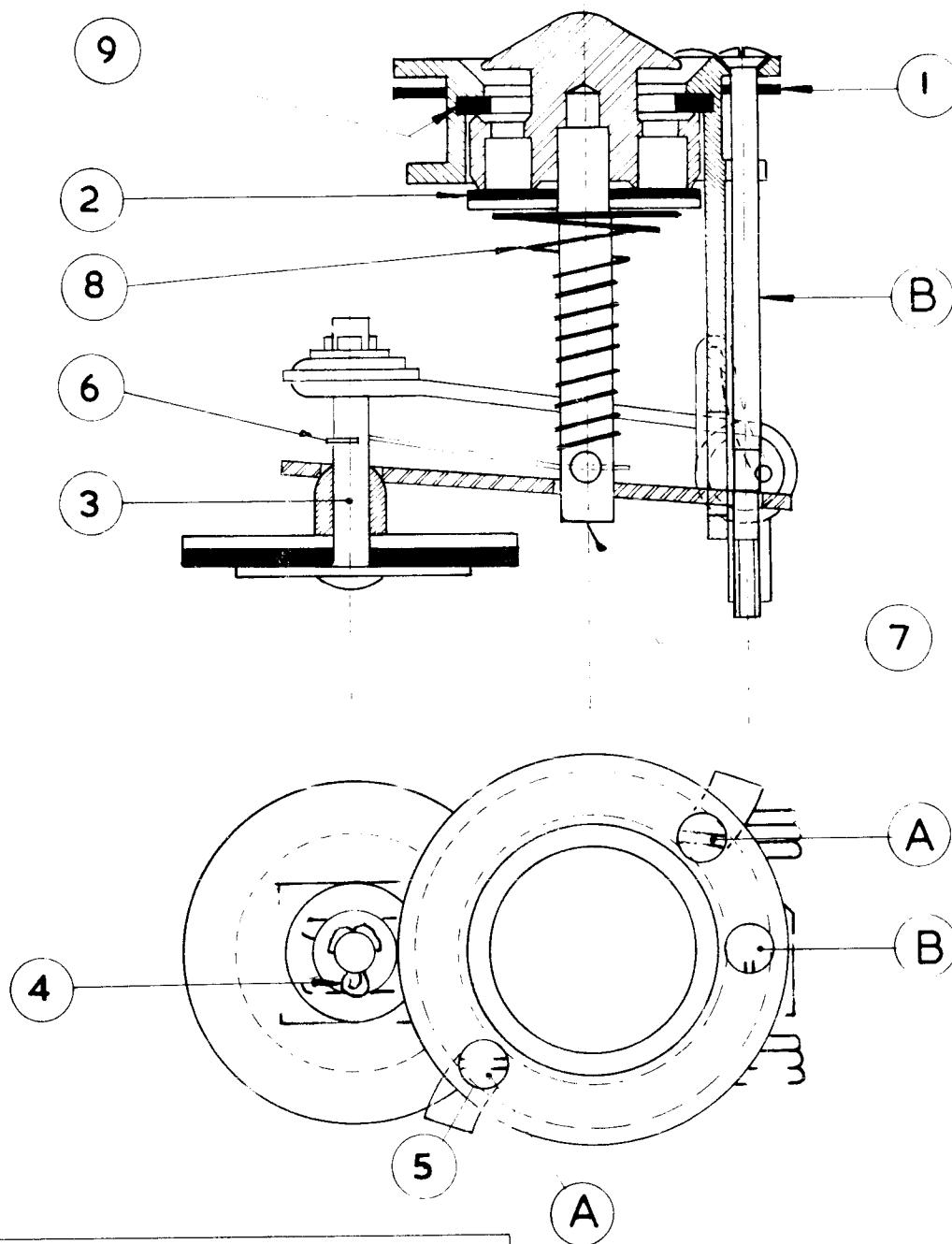
Remove 2 screws A and dogs and adjusting screw B. Remove old washer by stretching over body and fit new washer in the same way. Reassemble dogs and screws A and B. Check with drawing for correct position. The dogs should be a tight fit on screws A. Readjust unit as described below.

ADJUSTMENT OF UNIT FITTED TO INHALER

After fitting a new unit adjustment may be required to ensure correct seating of the valve. Screw B is provided for this purpose. Turning this screw clockwise will increase the closing pressure on the valve.

The screw should be adjusted so that the control point can operate the closing mechanism without undue force, and the valve closes soundly when checked as set out on page 1.1.

CLOSING MECHANISM



1 — Gasket Part No. 60923	3 — Valve and Stem Assembly Part No. 60930
9 — Plunger Sealing Washer Part No. 60925	7 — Spindle Part No. 60907
2 — Relief Valve Washer Part No. 60924	A — Screw for Dog Part No. 093
8 — Spring Part No. 60917	4 — Split Pin Part No. 092
B — Adjusting Screw Part No. 60926	5 — Dog Part No. 60904
6 — Cross Wire Part No. 60909	Closing Mechanism Complete Part No. 60900

Key to Drawing Sheet

See Text Page 2.11

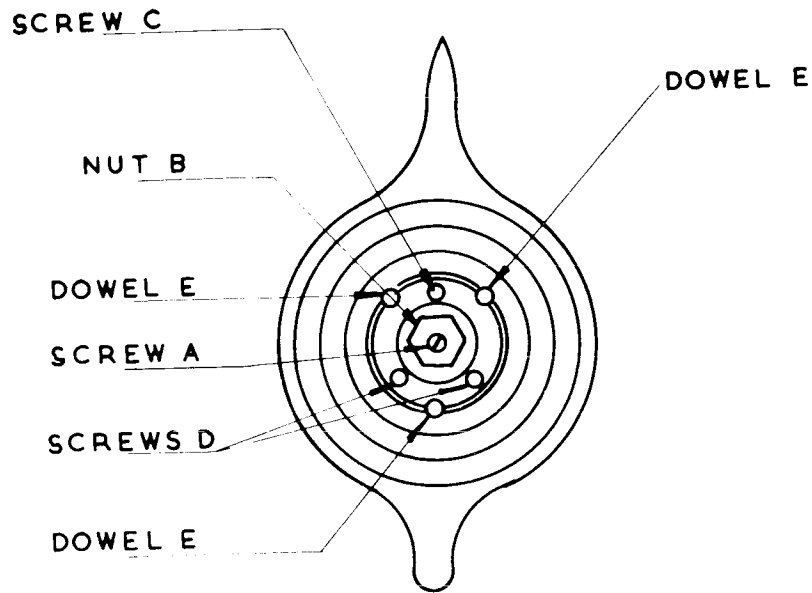


FIG 1

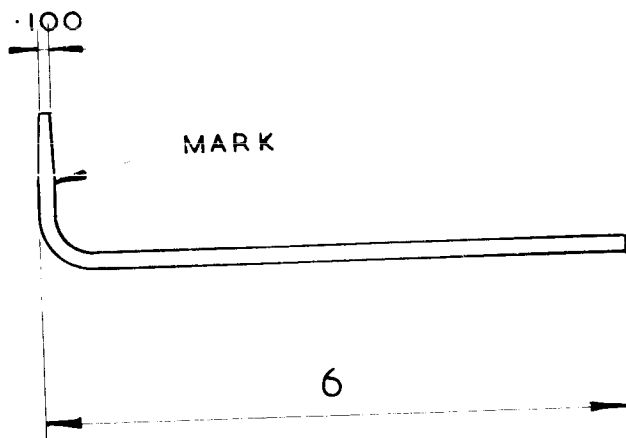


FIG 2

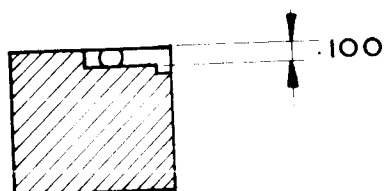
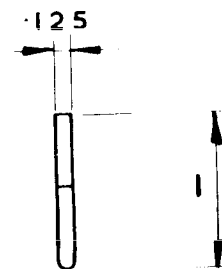


FIG 3

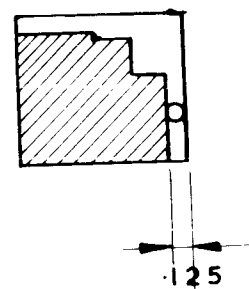


FIG 4

METHOD OF CHECKING ADJUSTMENT OF ROTOR

METHOD OF CHECKING ADJUSTMENT OF ROTOR

NOTE:— The rotor is correctly adjusted before leaving our factory, and should not normally be interfered with in any way.

These instructions are given for use only in cases where dismantling has been necessary for servicing and must be very carefully adhered to in detail. Only skilled personnel should be permitted to carry out the adjustment.

The rotor has both vertical and angular adjustment relative to the vapour port. Vertical adjustment is effected by screw A which is locked by nut B. Angular adjustment is provided by slackening three screws C and D. Screw C is a clamp only, those marked D have coned ends and by slackening one slightly and tightening the other, fine adjustment of the pointer can be obtained. (see Fig. 1.).

PREPARATION

The Inhaler should have the Temperature Compensator Unit removed as set out in the Sheet 24.9, and the top plate of the control knob must also be removed, together with the O-Seal and central spring which will be found below it. The spring dowels marked E in Fig. 1. must not be removed.

GAUGE

A special gauge is required which may be obtained from the manufacturers or made locally to the dimensions shown in Fig. 2. Penlon part number E.M.O. Tool 4.

SPECIAL NOTE:— Before carrying out the checks and adjustments set out overleaf, make sure that the rotor is pressed fully home in the body of the inhaler. This is normally performed by the spring which has to be removed, and after every movement of the rotor it must be pressed down to ensure that it has not been lifted.

TO CHECK VERTICAL ADJUSTMENT

Set the pointer at 4%. Insert gauge into Temperature Compensator well holding the long leg vertical. The short leg can then be entered into the Vapour Port, until a mark on the side of the gauge is level with the edge of the Temperature Compensator wall. At this point the width of the gauge in the rotor is 0.100" and the gauge should fit the gap between rotor and liner without slackness.

TO ADJUST ROTOR VERTICAL IF NECESSARY (Fig. 3)

Slacken nut B, screw OUT the adjuster A and press down the rotor. Screw IN the adjuster A until the gauge, when applied as stated above, indicates that the gap is correctly dimensioned at 0.100".

TO CHECK ANGULAR ADJUSTMENT (Fig. 4.)

Set pointer at the figure '1' of the 10% mark. Insert gauge as before but check gap between main step of rotor and edge of port as shown in Fig. 4. This dimension should be 0.125".

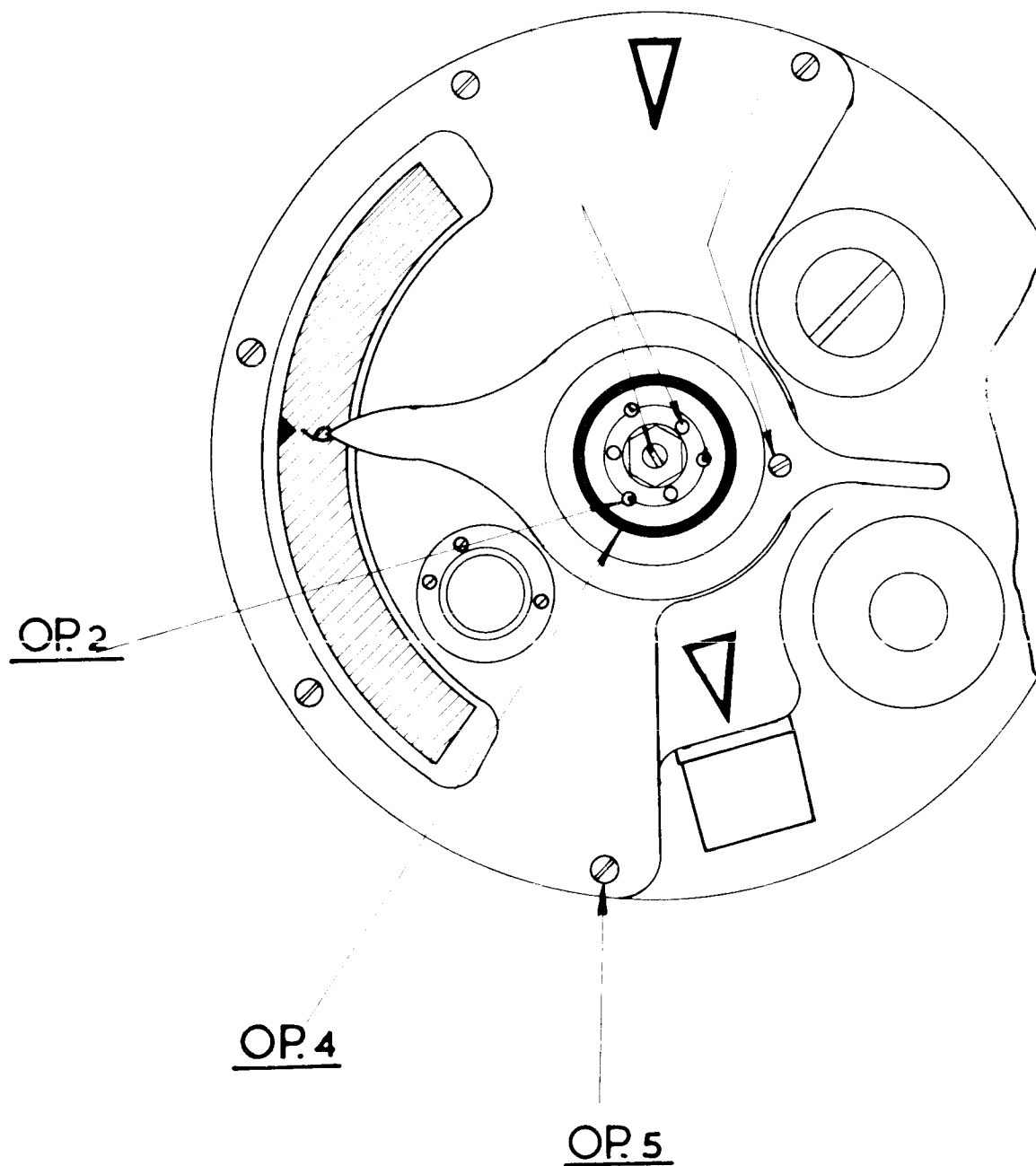
TO ADJUST ROTOR IF ANGULAR POSITION IS INCORRECT

Turn pointer until gap is wide enough to insert gauge as shown in Fig. 4., then turn pointer back until gauge is gripped. Slacken screws C and D (Fig. 1.) and set pointer to the '1' of '10' making sure that the rotor does not move. Tighten screw C finger tight only and make final adjustment to the '1' by tightening screws D a little at a time. Tighten screw C fully.

Remove gauge and recheck gap as set out above.

DO NOT DISTURB SOCKET HEAD SCREWS
OR CENTRE SCREW

OP.3



REMOVAL OF LID

LID AND POINTER ASSEMBLY

When it is necessary to obtain access to the interior of the E.M.O. Inhaler, the lid and pointer are removed as an assembly by following this sequence of operation. (See drawing 2.15).

1. Remove Ether label on the boss of the pointer (2 screws).
2. Remove 3 spring dowels, use special tool (E.M.O. Tool No. 5) or small pointed nose pliers.
3. Set control knob to 6% scale marking, remove plug in handle of control knob. Using a hexagon Allen key screw (E.M.O. Tool No. 6) inserted through the hole from which the plug was removed, unscrew and remove one Allen screw.
4. Remove O-ring and spring under Ether label and keep in a clean position.
5. Remove 5 screws round rim of lid and 3 near centre.
6. Lift off lid and gasket with pointer still assembled to lid. The closing mechanism may also be left attached to the lid.

Access can now be obtained to the rotor, if this has become stiff or seized, and to the air inlet port if the closing mechanism has been leaking. Any dirt or foreign body should be carefully removed from the mixing chamber.

ROTOR STIFF

If the action of the rotor is stiff, it may be removed by twisting and lifting, washed in ether, re-lubricated with a SMALL quantity of pure vaseline and replaced.

Do not disturb either the centre screw or the three hexagon socket screws indicated on the drawing. Ensure that the steel ball is in position in the base of the liner in which the rotor fits.

After reassembling the complete inhaler check the rotor setting as set out on page 2.13 and 2.14

ROTOR SEIZED

If the rotor has become immovable, a small quantity of penetrating oil should be applied round the periphery of the upper surface and through the ether port, reached via the temperature compensator well. Gentle warmth helps the action of the penetrating oil, which may take several hours to release the joint.

Using no undue force, grip the rotor boss with E.M.O. Tool No. 2 and attempt to turn and lift the rotor. If it is still immovable unlock and remove the central lock nut, and tighten the central screw. This will lift the rotor in the casting and help to break the point of seizure.

Repeat the process of oiling, twisting and lifting until the rotor is completely removed.

At no time should undue force be used. The inhaler may be damaged permanently unless great care is taken. In case of difficulty return the inhaler to the manufacturer.

The cause of the seizure is either a foreign substance in the ether, such as lacquer off ether cans, or the use of ether which has decomposed and contains aldehydes. In the latter case the liner may show considerable corrosion which must be carefully removed by scraping with a suitable steel tool.

On no account use sand-paper or emery cloth which may leave abrasive particles behind.

The rotor should be cleaned with metal polish, lubricated and reassembled as described above.

The adjustment and gauging technique described on pages 2.13 and 2.14 must then be carried out.

In cases of very bad corrosion, the body casting and rotor should be replaced and the defective parts returned to the manufacturers for rebuilding.

REASSEMBLY

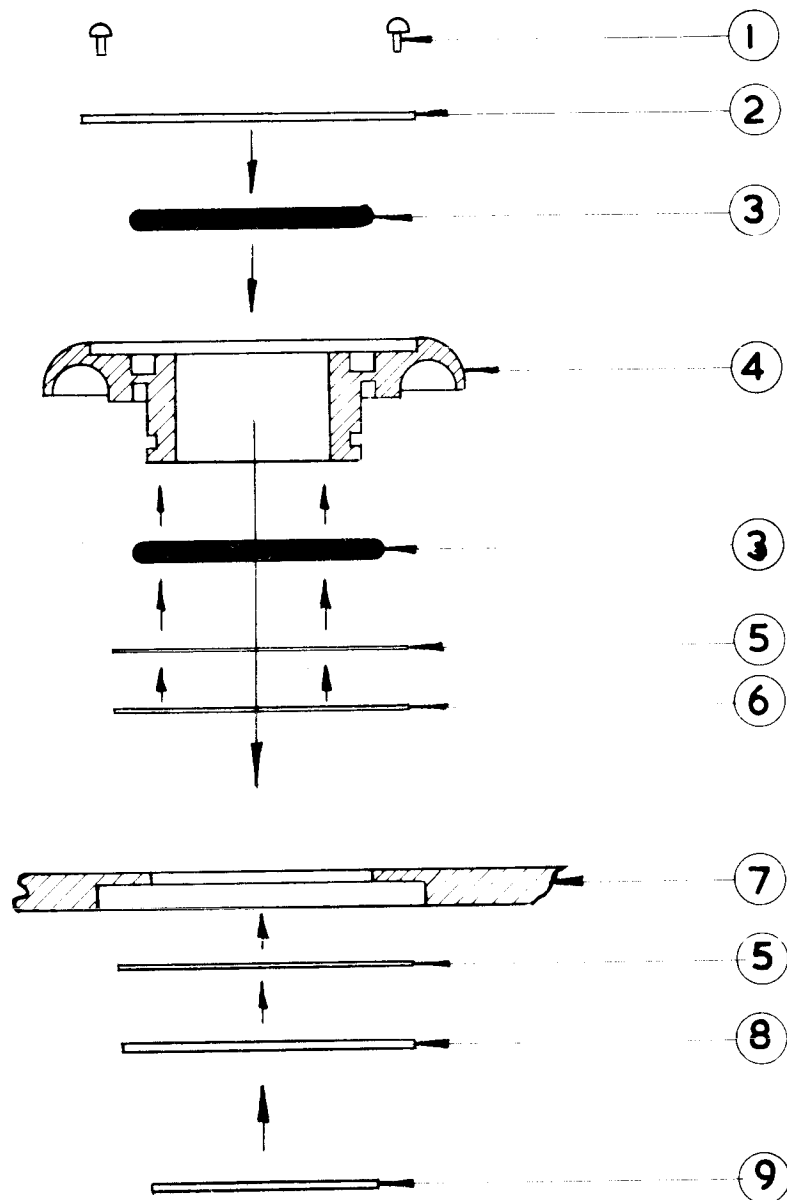
Reverse the procedure set out for dismantling. Always fit a new gasket between the lid and body.

Lid gasket	Part No. 61010
Spring dowels	Part No. 61023
Lid securing screws	Part No. 0102
Allen screw	Part No. 61017

REMOVAL OF CONTROL POINTER

If it is necessary to remove the control pointer because of damage or leaks, the lid assembly must first be removed from the inhaler.

The pointer is then released by removing the circlip 9, and the various sealing washers shown. When reassembling great care must be taken to replace washers in the positions shown, and new plastic or rubber parts should always be fitted. A list of part numbers is given on page 3.2.

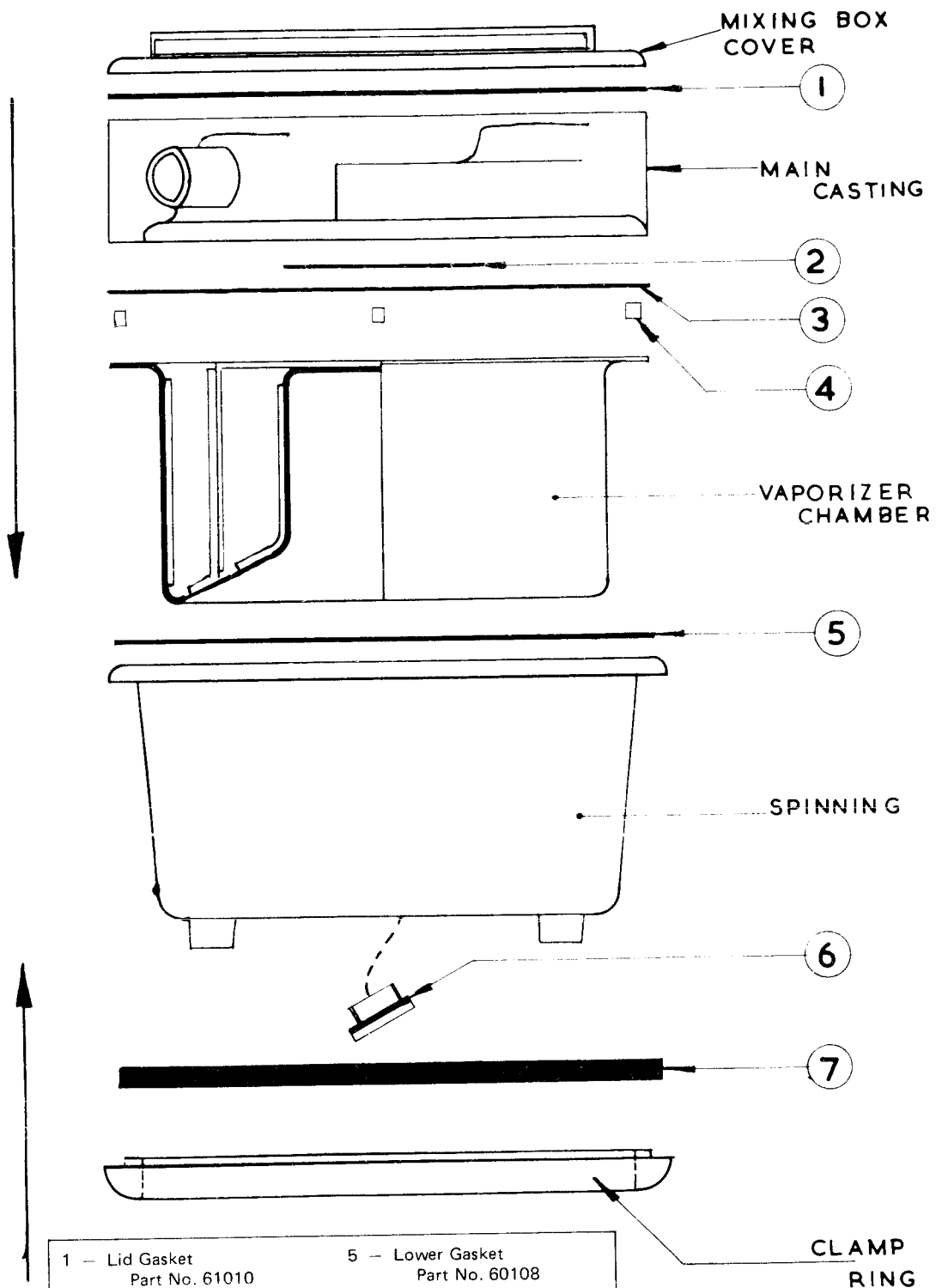


Key to Drawing Sheet 2.18

See Text, Page 2.17

1 — Screws Part No. 0104	6 — Washer (PTFE) Part No. 61006/B
2 — Centre Label Part No. 61011	7 — Lid Casting Part No. 61013
3 — O Ring Part No. 0110	8 — Pressure Plate Part No. 61007
4 — Pointer Part No. 61022	9 — Circlips Part No. 089
5 — Washer (Nylon) Part No. 61006/N	

REMOVAL OF CONTROL POINTER



- | | |
|--|---|
| 1 — Lid Gasket
Part No. 61010 | 5 — Lower Gasket
Part No. 60108 |
| 2 — Middle Wick Carrier Gasket
Part No. 60305 | 6 — Water Plug Gasket
Part No. 60104 |
| 3 — Upper Gasket
Part No. 60209 | 7 — Embellisher Band
Part No. 60119 |
| 4 — Insulating Bush
Part No. 60109 | |

Key to Drawing Sheet 2.19

See Text Pages 2.20, 2.21 and 2.22

ASSEMBLY OF MAJOR COMPONENTS OF E.M.O. INHALER

VAPORIZING CHAMBER

If access is required to the vaporizing chamber, the lid pointer assembly must first be removed as set out on page 2.16.

Empty any liquid either out of the vaporizing chamber, remove the water drain plug and empty the water jacket.

Remove all screws round the circumference of the mixing chamber (15 in all), after which the mixing chamber can be lifted off the vaporizing chamber. Remove upper gasket and three insulating sleeves, and then lift the vaporizing chamber out of the water jacket. Mk. I E.M.O. Inhaler has a cast aluminium water jacket, Mk. II has a stainless steel pressed jacket and an aluminium clamp ring which will be free when the screws round the periphery have been removed.

In both cases there is a gasket between the vaporizing chamber and water jacket.

TO REPLACE VAPORIZING CHAMBER COMPLETE

Dismantle as above and reassemble by reversing the operations using new gaskets.

Parts required:—

Complete vaporizing chamber with wicks	Part No. 60200
Gasket lower	Part No. 60209
Insulating Spacers (set of 3)	Part No. 60109
Fibre washers for screws (set of 8)	Part No. 0100

When reassembling the following points must be carefully checked:—

1. All parts must be scrupulously clean.
2. As the fixing screws round the periphery are irregularly spaced, care is necessary to position the gaskets correctly so that all the holes are aligned. It may be necessary to turn the gaskets over to meet this condition. The Upper Gasket has three enlarged holes into each of which an insulated spacer must be inserted. New spacers should be used if the old spacers are damaged with dismantling. Careful placing of the upper gasket and the use of the spacers ensures that none of the fixing screws makes metal contact between the vapour chamber and the water jacket. If available, an insulation tester should be used to check electrical insulation after assembly, one probe being held in contact with the water jacket, one with the vapour chamber (most easily reached through the temperature compensating well).

3. The fixing screws should be tightened gradually working alternately on one side and then the opposite side of the inhaler, in a similar manner to the cylinder head nuts of a car. They should be finally secured as tightly as possible with a normal screwdriver of the correct size to fit the screw heads.

4. The eight screws inside the mixing chamber must have fibre washers beneath their heads to ensure sealing. Any damaged washers should be replaced.

REPLACEMENT OF WICKS

The wicks of the E.M.O. Inhaler will last for many years, but occasionally it may be necessary to change them, possibly because of accidental contamination with some non-volatile fluid. Normally it is best to replace the complete vaporizing chamber in these cases, but circumstances may necessitate replacement of wicks.

Two principles must be remembered:—

(a) the material used is a vital part of the design. Only wicks supplied by the manufacturer should be used.

(b) it is essential to obtain the best possible contact between the wicks and the metal surfaces which support them to ensure heat conductivity and correct vaporisation.

Three sets of wicks are fitted.

Inner wick	Part No. 60203
Middle wick	Part No. 60309
Outer wick	Part No. 60206
Clips for middle wick (set of 4)	Part No. 60307
Middle wick carrier gasket	Part No. 60305

NOTE:— Older inhalers have two brass stretchers for the outer wick. Replacement outer wicks will be of the latest type, with built in stainless stretchers.

Having dismantled the inhaler and removed the vapour chamber, proceed as follows:—

1. Remove the gasket fitted to the centre of the vapour chamber, (one screw).
2. Three screws will now be visible on the centre portion of the upper surface. Remove these and lift out the middle wick assembly.
3. Remove inner and outer wicks, noting the position of the 'tails' on the inner wicks carefully.
4. Fit new inner wick by stretching it over the centre boss of the vaporizing chamber. The cut out in the wick must be in the same position as the original to clear the temperature compensator and level indicator well.
5. Cut the wires securing the old middle wick to its carrier, fit the new wick in the same position and secure by the new wires and clips supplied.
6. Fit new outer wick by springing into place. Check for close fit to chamber walls. Adjust by bending stretchers if necessary. The stretcher wires must be INSIDE, and not in contact with the vaporizing chamber.

7. Reassemble middle wick carrier. Note, the screws' holes are unevenly spaced to prevent assembly in incorrect position.
8. Fit the top gasket, replacing if necessary.

OXFORD INFLATING BELLOWS

This should be regularly inspected but no servicing is necessary unless inspection reveals faults.

The following points should be checked:—

1. The bellows should be examined for cracks in the rubber.
2. The glass domes should be checked for cracks.
3. The magnet should be fitted to its support to check that it lifts the outlet valve clear of the valve seating.
4. After replacing the magnet in its storage holder, block the inlet port with a cork and attempt to extend the bellows. This tests the outlet valve. It should not be possible to extend the bellows more than 2.5cm (1") in 1 minute.
5. Transfer the cork to block the outlet port and attempt to compress the bellows, testing leaks through the inlet valve. Again, movement should not exceed 2.5cm (1") in 1 minute. Remove the cork.

REPAIRS

1. To replace the bellows if perished.

Either complete bellows assembly can be fitted after unscrewing the old unit, or a new rubber can be attached to the existing end fittings. In the latter case, remove the bottom plate first by taking out the 4 small screws, and levering off the plate which has been cemented on with Bostik.

Loosen the inner bottom plate. Access can then be gained to hold the ball ended bolt attached to the top plate.

Holding this bolt with pliers or spanner, unscrew the hand knob on top of the bellows, releasing the bolt, spring and bottom plate. The old bellows can then be pulled off the top plates.

Clean all old cement off the end plates.

Insert the inner top plate into the bellows. Apply a small but continuous ring fillet of Bostik to the groove in the outer top plate, position this on the bellows and insert the hand knob. Enter the spring into the bellows from the other end, apply the ball ended bolt and tighten to the knob. Bostik can be applied to this thread for sealing, also care must be taken to keep the bellows and plates concentric during tightening.

Stretch the bellows over the inner lower plate and position the ring on the bellows edge in the groove in the plate. Apply Bostik to the groove in the outer bottom plate and to the thread of the four small screws. Assemble the bottom plate with the screws, again ensuring concentricity of the rubber in the grooved end plates.

Allow Bostik to dry for about 1 hour before testing the bellows for leaks.

2. Replacing glass valve domes.

Note that the metal clamp rings are not interchangeable between inlet and outlet valves. Always use new gaskets with new glasses and tighten the fixing screws in rotation, a little at a time, as with a cylinder head.

Always check to ensure that the magnetic valve disc is installed in the outlet valve assembly, after dismantling the valve body.

LIST OF SPARES

Bellows Assembly – complete (Adult size)	Item 51212
Bellows Rubber only (Adult size)	Item 51213
Bellows Assembly – complete (Paediatric size)	Item 51214
Bellows Rubber only (Paediatric size)	Item 51215
Magnet	Item 51015
Glass Dome	Item 51019
Pair of gaskets for Dome	Item 51018
Inlet valve disc (plain)	Item 51017
Outlet valve disc (magnetic)	Item 51016

SERVICE DATASHEET



Item	Part No	Description	Req'd
1	62883	Base	1
2	020015	Wing Nut M5	1
3	22020	Pressure Relief Valve	1
4	62885	Adaptor	1
5	39875	Taper Connector -inspiratory	1
6	053212	Plug	1
7	0117	O-ring	2
8	041105	O-ring (not shown)	1
9	15056	Label (not shown)	1
10	39883	Seal	2
11	39884	Valve Seat	2
12	62889	Valve Disc (magnetic)	2
13	39892	Dome	2
14	62810	Bellows Assembly	1
15	62884	Arm	1
16	62886	Magnet	1
17	01008	Screw M4 (for magnet - not shown)	1
18	011259	Pad (for base - not shown)	4
19	62888	Taper Adaptor	1
20	041216	O-ring (not shown)	1
21	041246	O-seal	1
22	041207	O-seal	1

SPARE PARTS LIST FOR E.M.O. INHALER

NOTE:— Always quote serial number of inhaler and specify anaesthetic agent for which it is calibrated

	Part No.
FILLER UNIT (see page 2.4)	
Service Unit complete	60500
Knob Item 1	60501
Seal Item 2	60504
Spring Item 3	60512
Body Item 4	60519
Gasket Item 5	60517
Plunger Item 6	60518
Base Plug Item 7	60510
LEVEL INDICATOR (see page 2.7)	
Service Unit complete	60600
Top with glass Item 1 & 2	60601/12
Flag and pole Item 3 & 7	60608
Gasket Item 4	60616
Cage Assembly Item 5 & 6	60604
Float and wire Item 8	60613
TEMPERATURE COMPENSATING UNIT (see page 2.8)	
Service Unit complete Mk. I and II as page 2.8	61601
Lower Sealing Ring Item 4 page 2.8	61658*
Upper Sealing Ring Item 1 page 2.8	61647*
Washers for screw heads Item 2 page 2.8	60906
Washers for spacers Item 3 page 2.8	60906
Top cover with glass Item 5 (for Mk. I & II)	61666 &
	61668
	0518
* From January 1968, these are both replaced by O ring	

Spare parts list (contd/...)**Part No.****CLOSING MECHANISM (see page 2.11)**

Service Unit complete	60900
Gasket Item 1	60923
*Nylon washer for screw head 2 per screw	60906
Dog Item 5	60904
Screw for Dog Item A	093
Adjusting screw Item B	60926
Relief valve washer Item 2	60924
Valve assembly Item 3	60930
Split Pin Item 4	092
Plunge sealing washer Item 9	60925

LID AND POINTER ASSEMBLY (see pages 2.15 and 2.18)

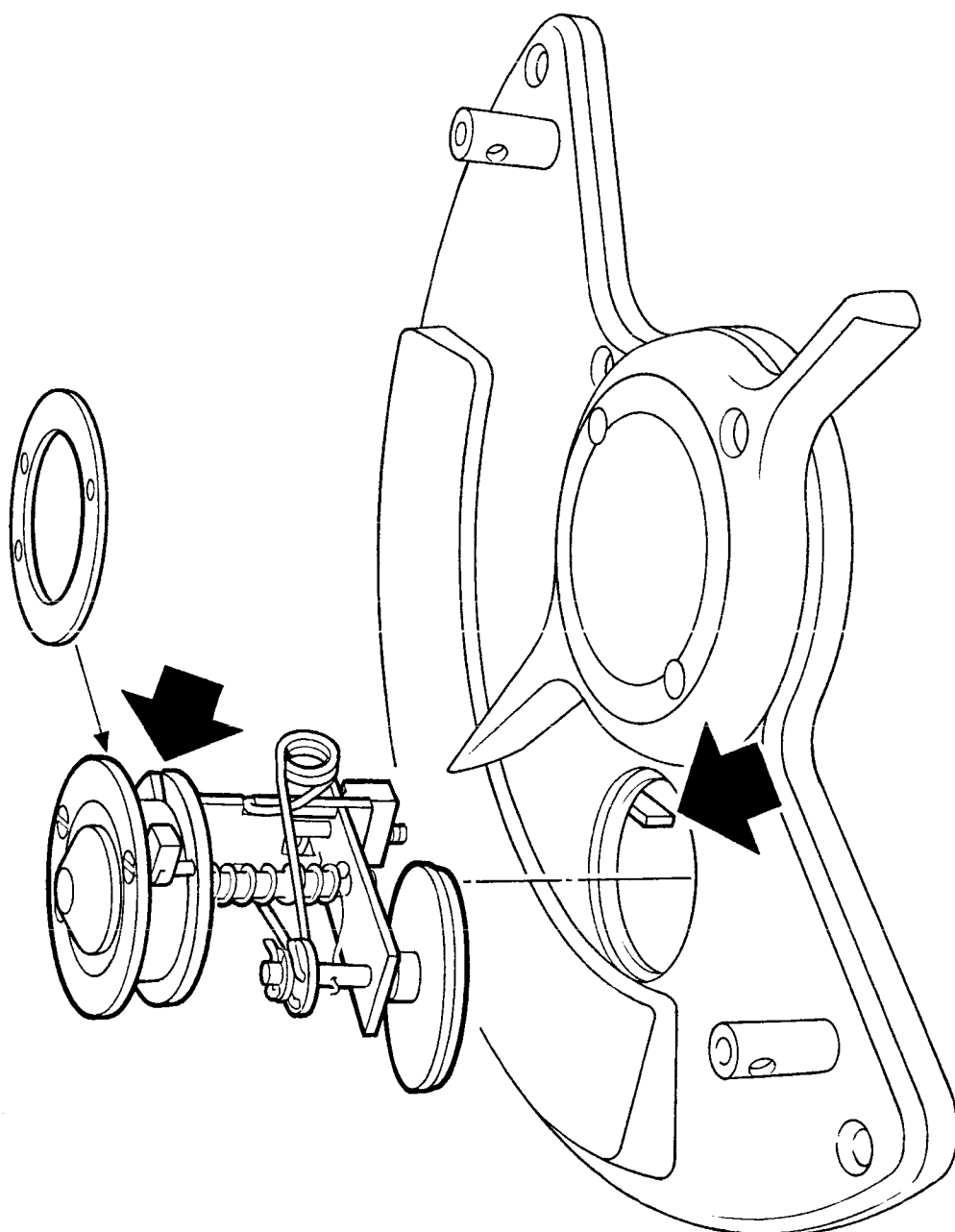
Service Unit complete	61000
Centre label (Item 2 page 2.18)	61011
Fixing Screws for above (Item 1 page 2.18)	0104
O ring (Item 3 page 2.18)	0110
Spring	60804
Spring Dowel (Op 2 page 2.15)	61023
Knob Blanking Screw (Op 3 page 2.15)	61019
Allen Screw (Op 3 page 2.15)	61017
Lid Fixing Screws (Op 5 page 2.15)	0102
Pointer (Item 4 page 2.18)	61022
Washer (Item 6 page 2.18)	61006/N
Washer (Item 5 page 2.18)	61006/B
Pressure plate (Item 8 page 2.18)	61007
Circiip (item 9 page 2.18)	089

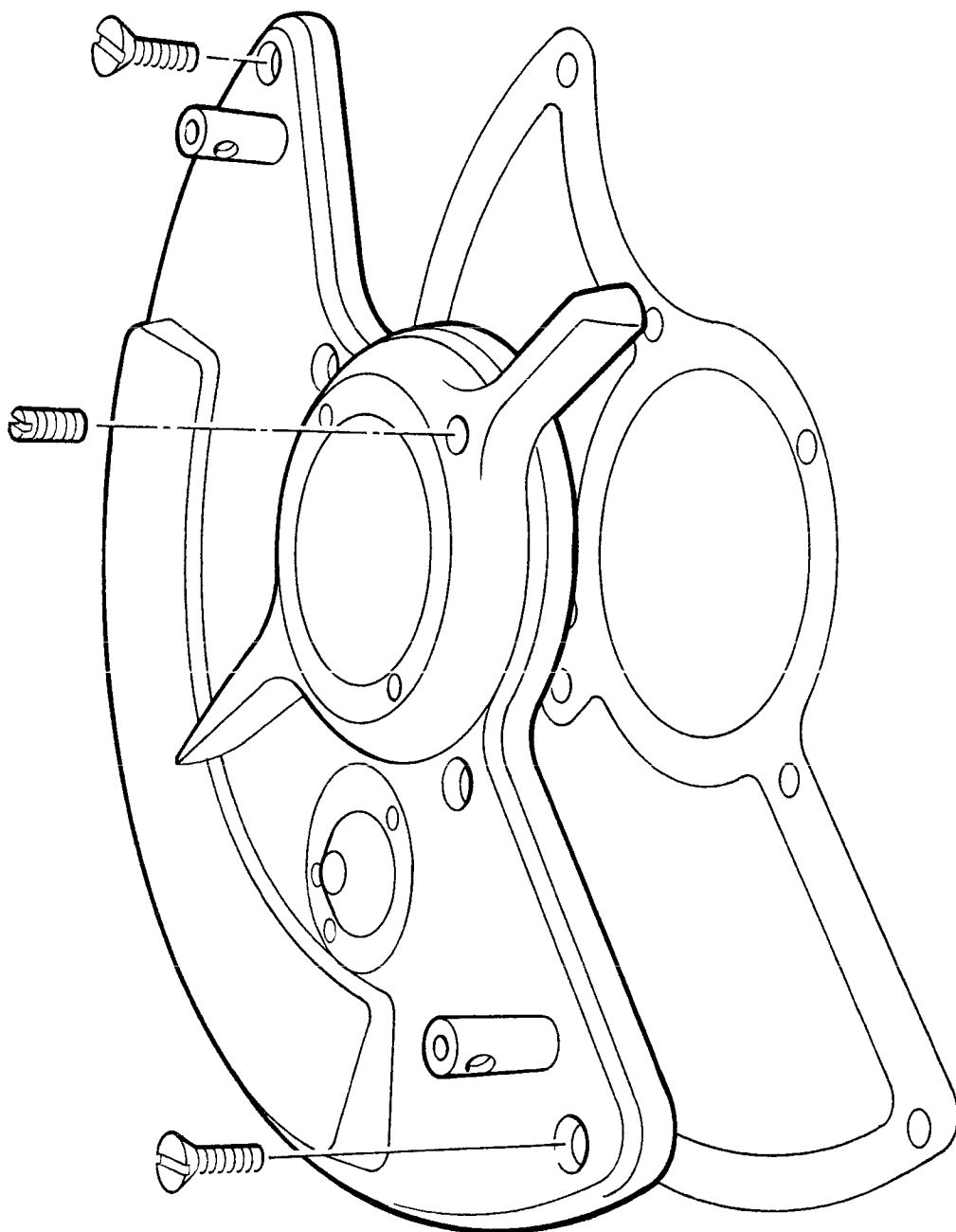
VAPORIZING CHAMBER ASSEMBLY (see page 2.19, 2.20 and 2.21)

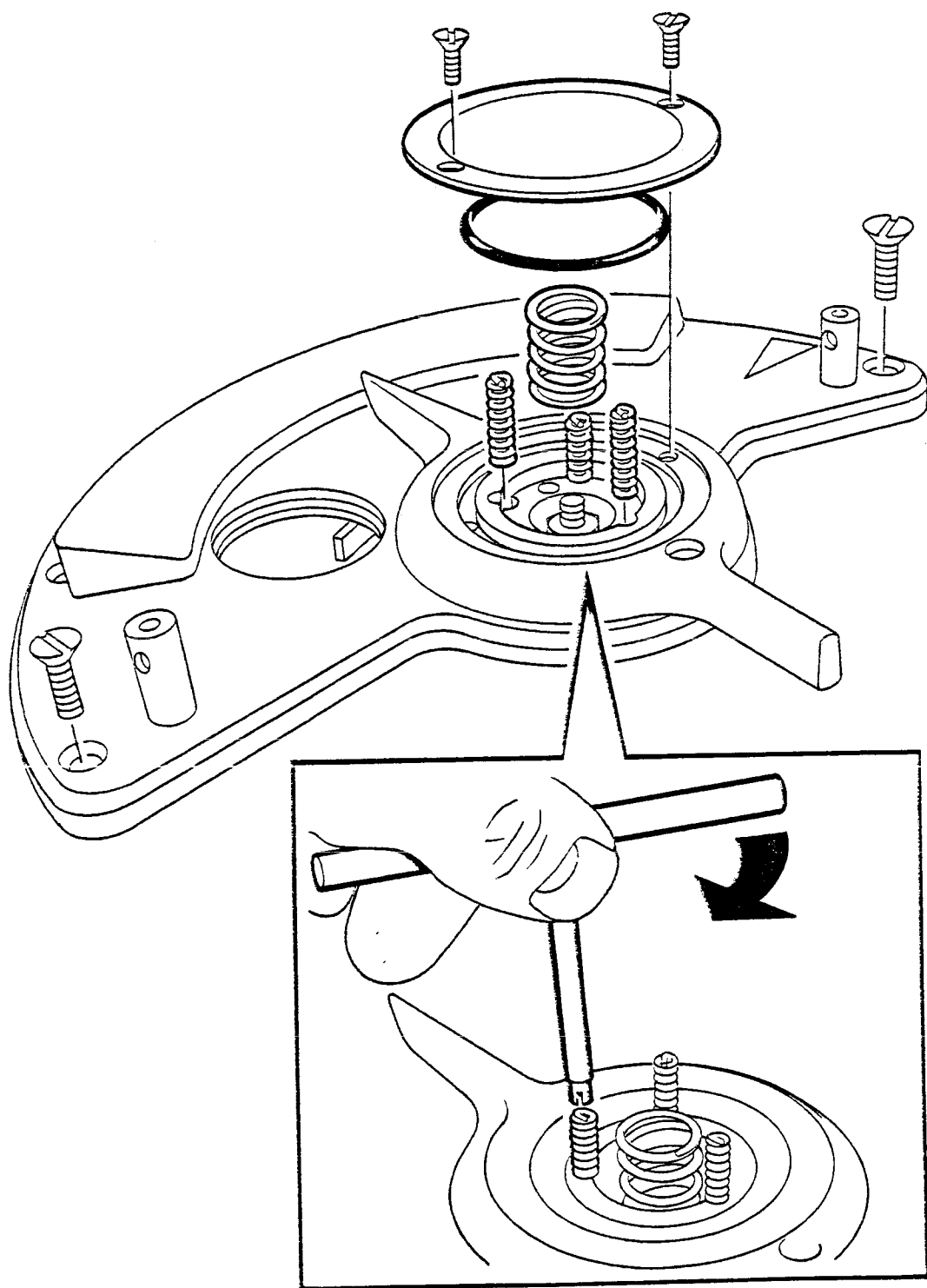
Service Unit complete with wick	60200
Copper spinning only	60201
Liner wick	60203
Middle wick	60309
Outer wick	60206
Clips & wire for middle wick	60307
Middle wick carrier gasket Item 2	60305
Upper gasket Item 3	60209
Insulating Bush Item 4	60109
Lower Gasket Item 5	60108
Water Plug Gasket Item 6	60104
Embellisher Band Item 7	60119

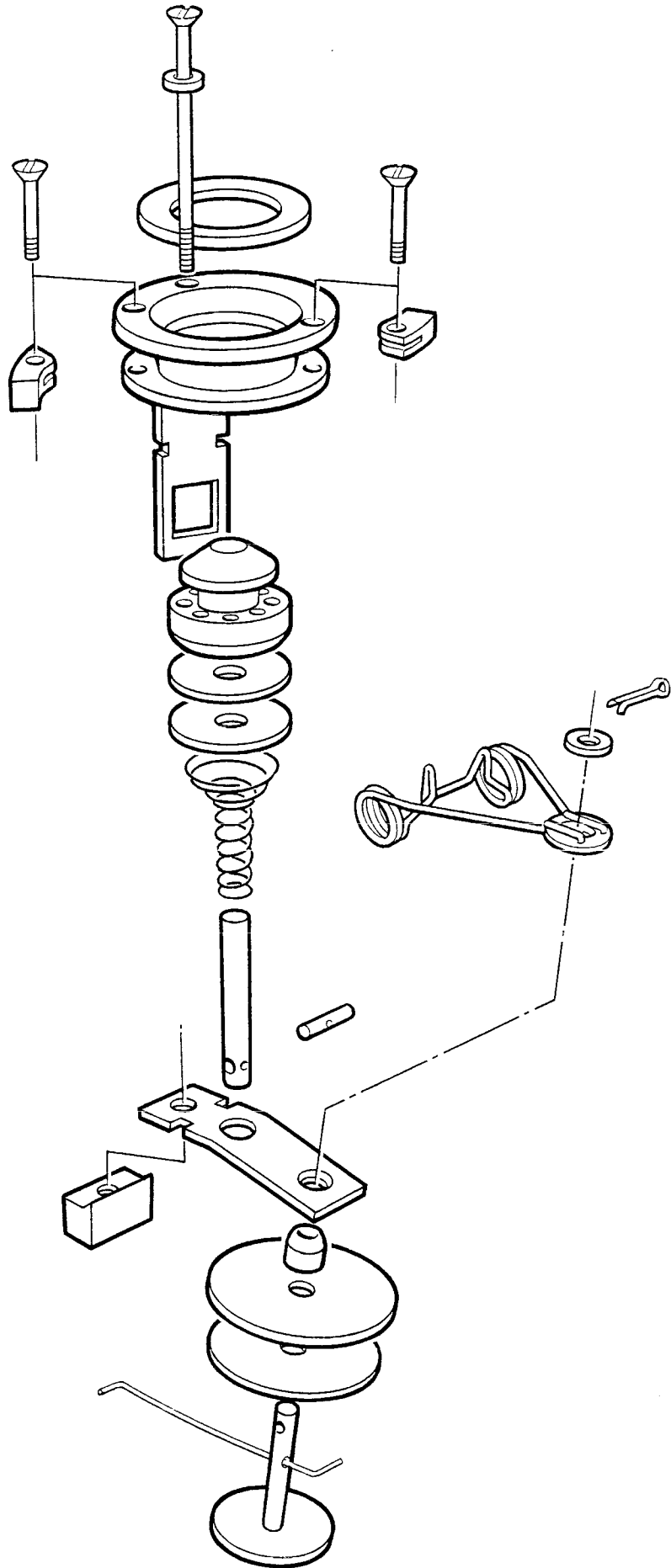
EMO Service Manual - Appendix

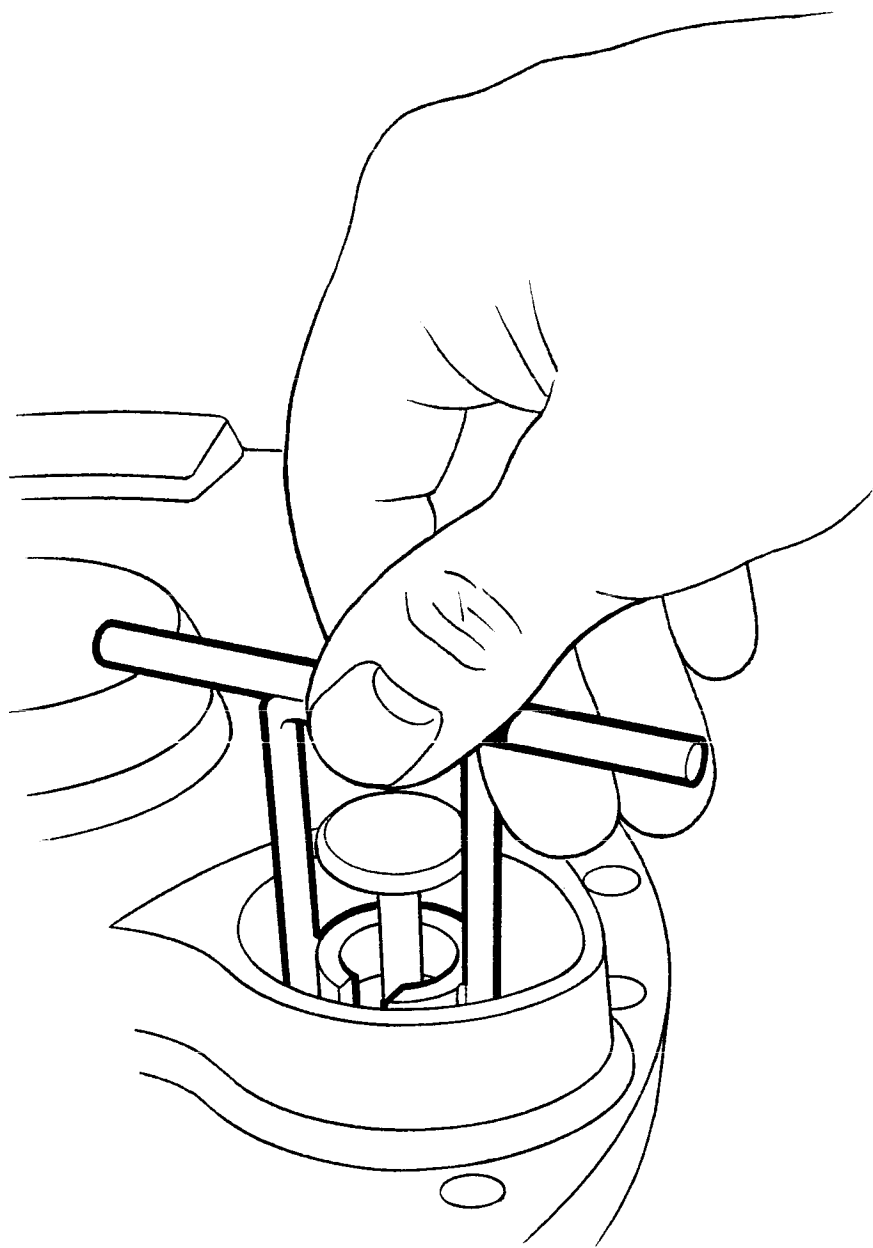
Service illustrations - component dismantling procedure

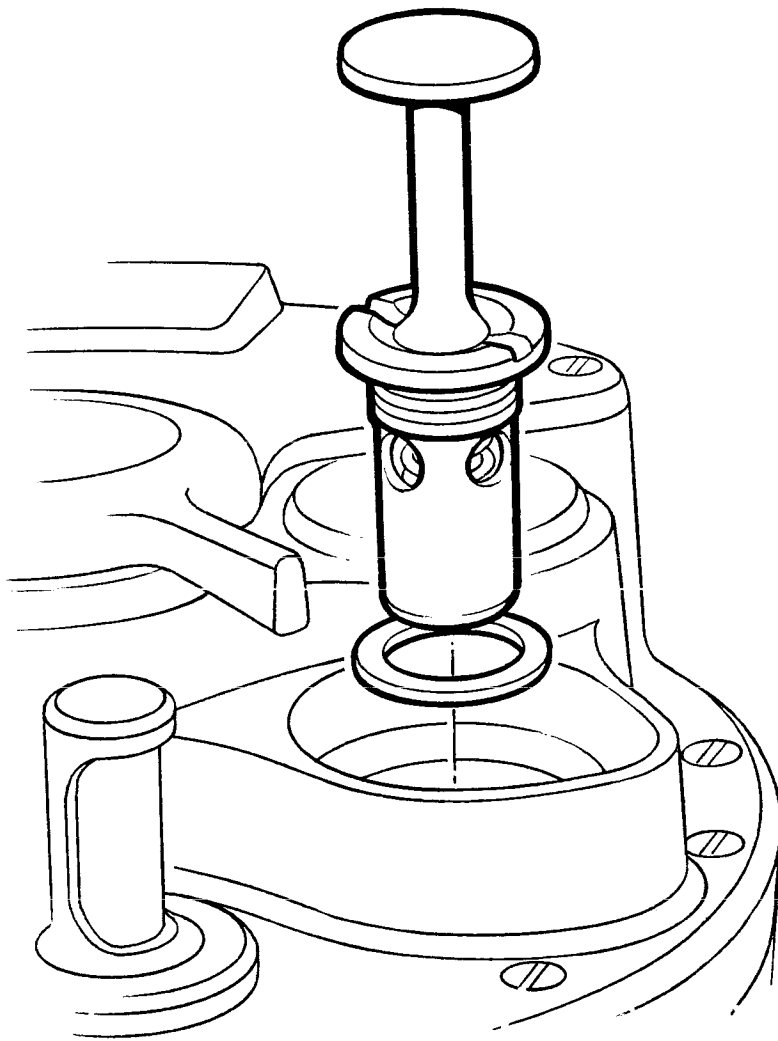


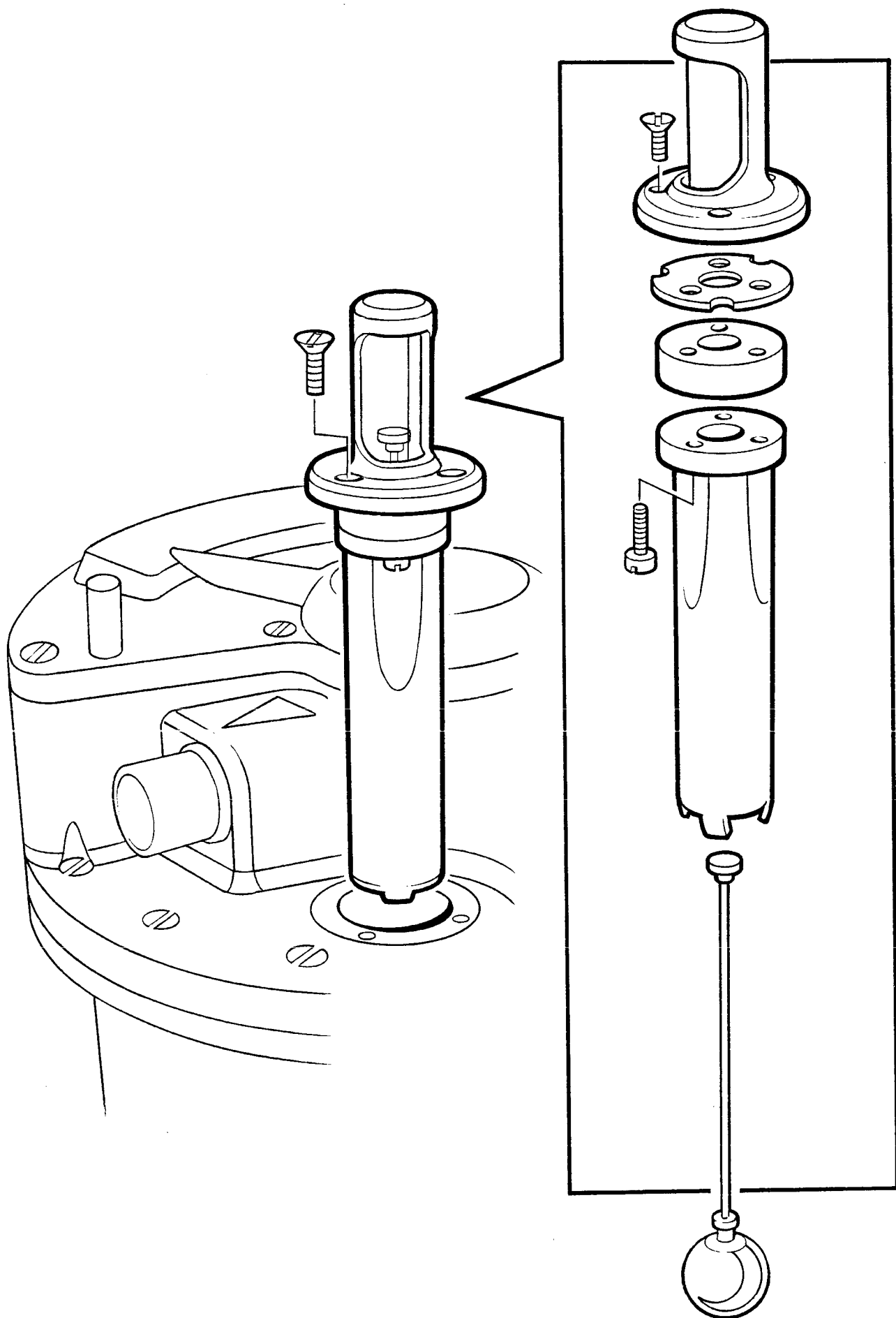


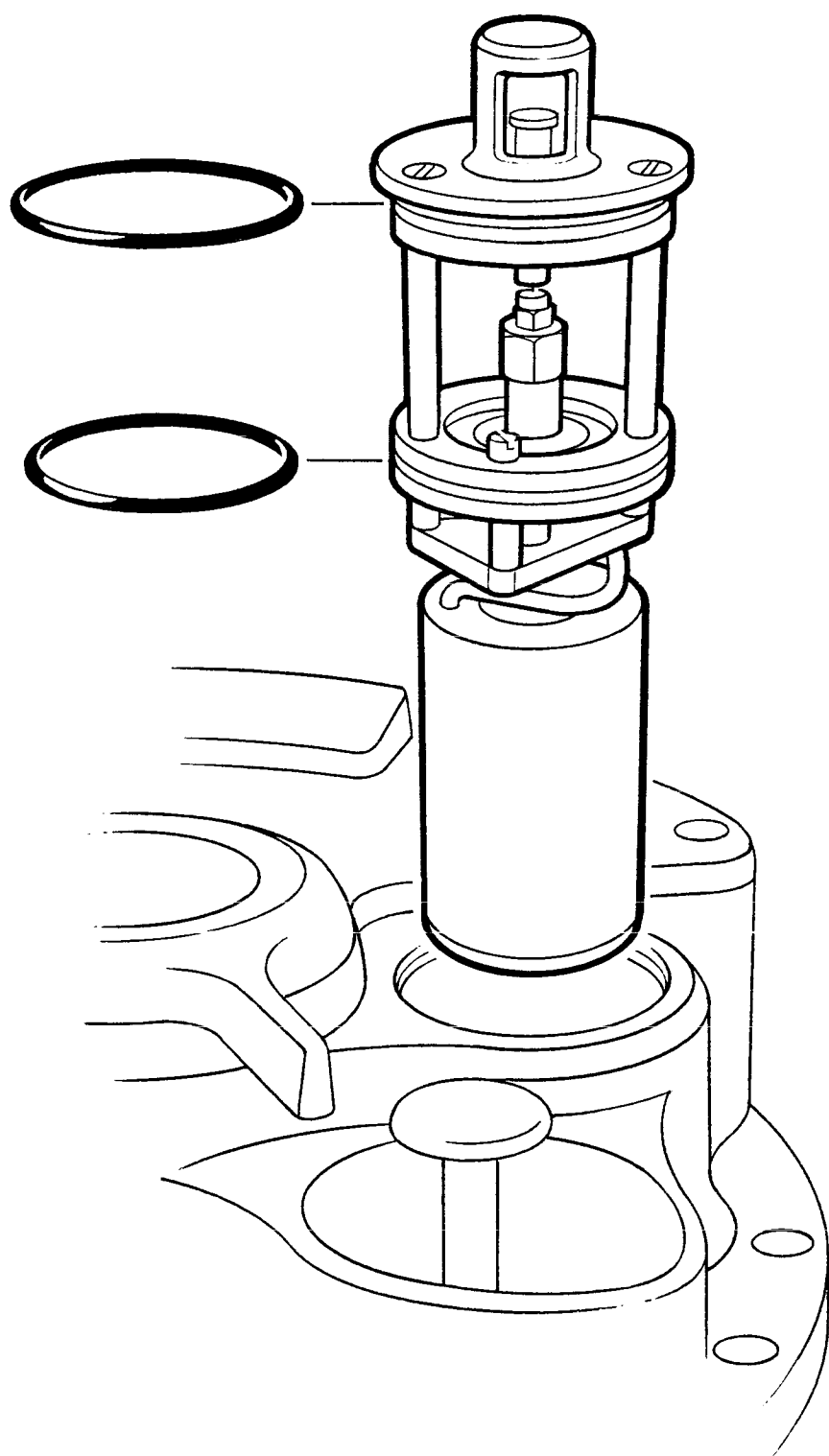


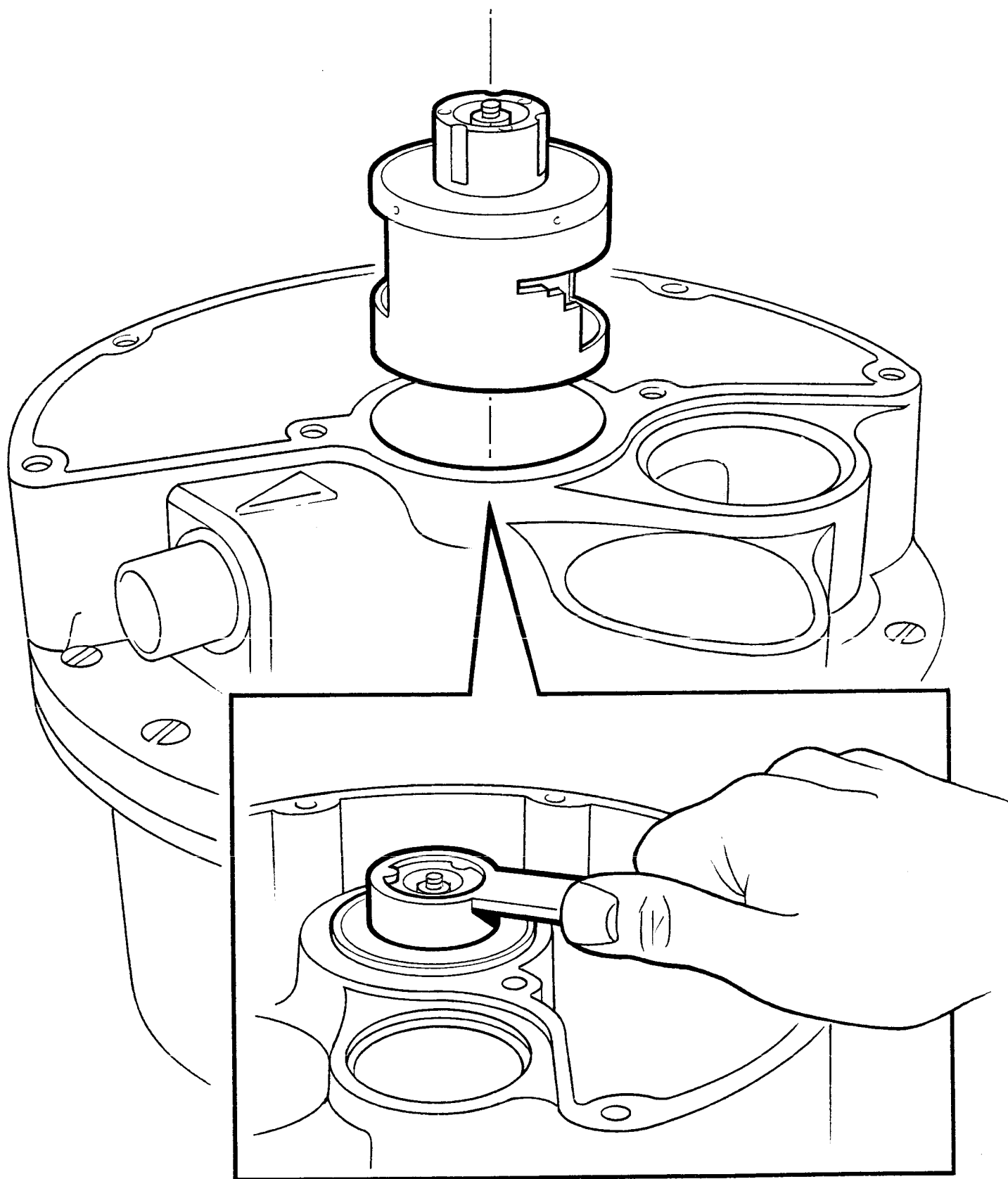


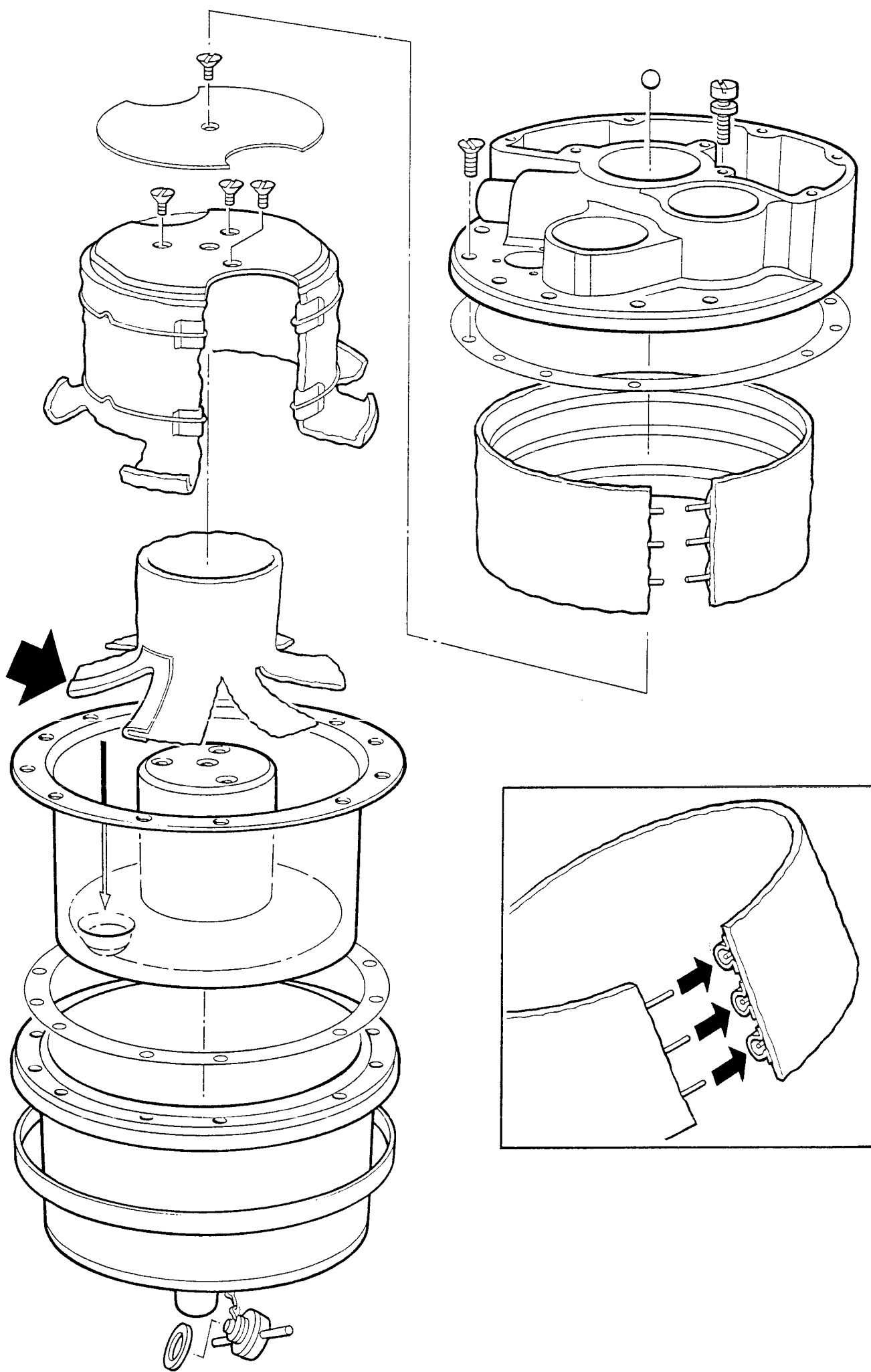














Cat No. 51011

Penlon Ltd
Abingdon Science Park
Barton Lane
Abingdon
OX14 3PH
UK
Tel: 44 (0) 1235 547076
Fax: 44 (0) 1235 547062
E-mail: technicalsupport@penlon.co.uk

