ANAESTHETIC MACHINE
THESIS

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Degree in
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By

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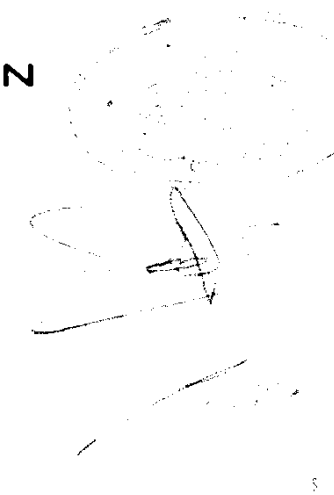

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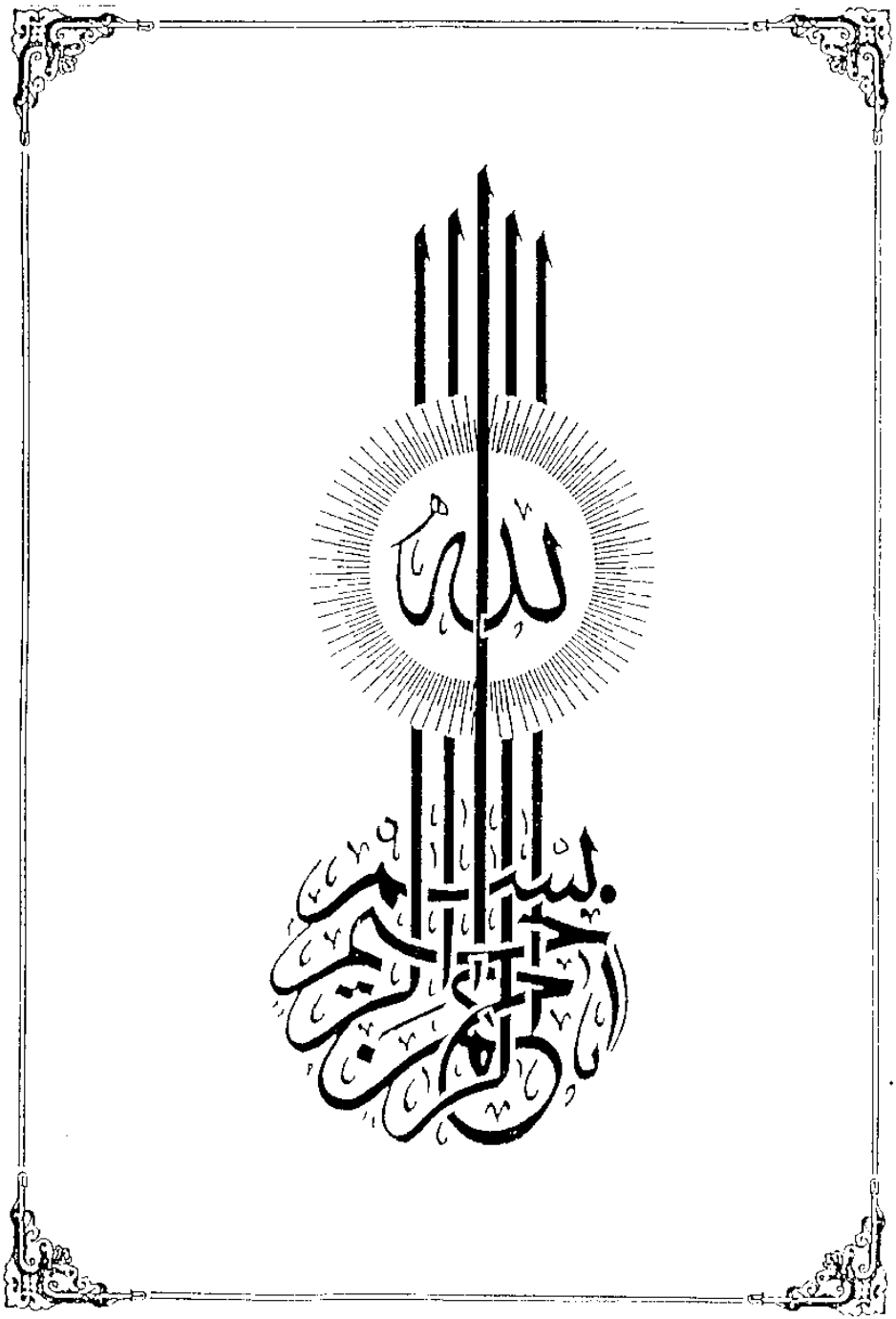

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The CANDIDATE.

C O N T E N T S

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INTRODUCTION

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As the anaesthetist's best clinical efforts can so easily be frustrated by simple malfunction of apparatus we expect that there will be a wide spread welecome for this text to review the design & function of the components of the modern complex anaesthetic machine.

After the introduction of nitrous oxide for dentistry in New York (1862) and its demonstration in London by Evans and Colton (1868) Clover was encouraged to design an apparatus for its use as an induction agent before ether, followed by refine ment by Hewitt of an apparatus for Nitrous oxide -Oxygen anaesthesia with a description of his apparatus and methods of adminstration in his text book on "anaesthetics and their Adminstration" by Hewitt in (1893). The availability of both gases in compressed cylinders led to a new wave of technical development in the United States by dentists like S.S. White, Teter and Heidbrink who intreduced improved apparatus to utilize the methods of Hewitt advocated.

When Boothby and Colton added the bubble flowmeter, this provided, for the 1st time, visual evidence of the mixture delivered. The demonstration by Gwathmey in London in (1912), of his machine incorporating these flowmeters

led Boyle to obtain a Gwathmey machine which served as a model for machines made for the British Army during World War I to become known as "Boyle machines". After fifty years of development and refinenment had changed it beyond recognition, the tide of innovation carried the Boyle machine back across the Atlantic where U.S.A. manufacturers were influenced to adopt its modular construction and incidentally, its lay-out. This lay-out with the flowmeters on the left and the outlet to the patient on the right, was designed by Boyle for convenient use of the machine on his left side, as he was left handed.

Another innovation which bloomed later was the clinical use of cuffed endotracheal tubes and endobronchial tubes. Though introduced into anaesthetic practice by Waters in the United States, they were developed by Magill and subsequent anaesthetists in Britain into a complete armamentarium to which was added later the Swedish Carlen's double lumen bronchospirometric tube. Many variants of endbronchial and double lumen tubes were developed later.

INHALING ASSEMBLY AND BREATHING RESERVOIR.

FACE PIECES

These are commonly made of antistatic rubber or plastic. They are made to fit the anatomy of the face and some are designed to minimize the dead space specially for children, infants and neonates.

PARTS:

Face piece (mask) is made of angled piece, with 22 mm British Standard (B.S.) taper and body which might be seprate entity or might be one piece with edge which is designed as a cushion filled with air.

TYPES AVAILABLE:

1. Everseal
2. BOC face piece.
3. Ambu
4. Mckesson face piece for dental operation.
5. Rendell-Baker pediatric face piece.

They are avialoble insizes from 1-5 except Rendell-Baker from 1-3.

ENDOTRACHEAL TUBES

TERMINOLOGY:

Endotracheal tube is one through which anaesthetic gases or vapors as well as respiratory gases are conveyed into and out of trachea.

Construction Requirements

1. Inertness: non toxic, non allergic, resistante to detorioration from autoclaving or chemical sterilisation.
2. Smooth: on the outside.
3. Rigidity: ability to retain curved shape.
4. Conductivity:.

Classification According to Construction:

1. Metal (M) made of coiled metal, flexible, covered by a latex or rubber sheath, can not be kinked or compressed.
2. Semirigid (S) made of coiled wire or heavy silk or nylon incorporated in a tabular wall of rubber, latex or other synthetic elastic material.
3. Soft tubes
   (a) Rubber (R)

. Magill:- rubber or neoprene compound.

. Oxford: or (inverted L-shaped tube). It has two limbs which are shaped to conform to the passage from the mouth to the trachea. Its internal diameter is fixed allthrough,

- Murphy: rubber, blunt bevel, side vent plain or cuffed with pilot balloon.
- Cole's: narrow distal end, upper portion wide, shoulder rests on the glottis useful in infants & neonates.

(b) Plastic (P)

Made of synthetic pliable material may be opaque or translucent; polyethylene (portex). Vinyl plastic (collins) semitransparant).

(c) Latex

Saunders: spiral nylon monofilament embeded in the wall.

Designation of Sizes:

Four main systems.

1. The French gauge.
2. Magill Number (Arbitrary No)
3. Internal diameter
4. External diameter.

Distinction between oral and nasal tubes.

1. Radius of curvature: oral 14cm. ± 10%. nasal 20cm. ± 10%.
2. The bevel: oral: minimum bevel angle not less than 45° in relation to its long axis.

   Nasal: minimum bevel angle not less than 30° in releation to its long axis.

A guide to the length and the internal diameter of endotracheal tubes:

Internal diameter		Length		Age (years)
Oral and Cuffed	Nasal	Oral plain	Nasal Plain	
2.5	-	5		0-1 yr
3.0	-	5		
3.5	-	5		
4.0	-	5½		
4.5	-	5½		1-2yr
5.0	5.5	6		2-4yr
5.5	6.0	6¼	8	
6.0	6.5	7	8½	5-12yr
6.5	7.0	7½	9¼	
7.0	7.5	8	10	13-16
7.5	8.0	8½	10	
8.0	8.5	9½	10½	
9.0	-	9½		Adult
9.5		10		
10.0		10		
11.0		10		

Endobronchial tubes:

a. Magill left magill right with;wire coil.

b. Machray: left sided, short cuff.

c. Green-Gordon: Right sided for right lung it has a carinal hook.

d. Macintosh:-Leatherdale: left sided, two cuffs tracheal and bronchial.

e. Brompton (Pallister): left sided, one cuff tracheal, two cuffs bronchial (one inside the other)

F. Vellacott: right sided.

Double Lumen tubes

1. Carlens: with carinal hook into left bronchus.

2. Bryce-smith: No hook into left bronchus.

3. White with carinal hook into right bronchus.

4. Robert shaw low resistanc tubes for right and left lung.

Care of tubes:

Rubber tubes are kept in cool place away from sunlight stored in a circular receptacle to maintain the curvature.

Cleaning of tubes

1. Mechanical.

2. Sterilisation.

a) Autoclaving (steam sterilisation).

b) Gas sterilisation.

c) Chemical sterilisation.

3. Storage in a sterile package.

ENDOTRACHEAL CONNECTORS

They join endotracheal tube to the catheter mount. Various types are available.

Features:

1. Special angle:- for nasal tubes .
2. Two pieces:- for rapid connection and disconnection
3. Provision for suction.

Types avialable

1. Magill nasal & oral. 2. Magill suction: provide a part for sucction.
3. Rowbotham right angled.
4. Cobb's suction with a metal rubber cap.
5. Nosworthy: one curved connector with other straight ones (to allow rapid connection and disconnection and allow for suction).
6. Knight's pediatric connectors, one curved and other straight ones .
7. BOC international connectors, one curved and several straight ones. Metal endotracheal connectors may be auto claved or cool-sterilised.

CORRUGATED HOSES

Corrugated hoses or breathing tubes are normally available in standard lengths of 7½, 12, 32 and 42 inchs (0.19, 0.30, 0.81, and 1.07 meter) with an internal diameter 20mm at least.

They are usually made of antistatic rubber, also available in plastic (e.g. Neoprene, P.V.C.)

They should not be exposed to sunlight or ultraviolet light which can affect the composition of rubber and thus should be kept in a cool dark place and cleaned regularly. They have the ability of absorption of inhalation anaesthetic agents (e.g Halothane and Methoxyflurane) Corrugated hoses are relativly compliant and their expansion during the inflation phase of ventilation can significantly alter the wave-form generated by a ventilator.

Non distensible tubing should be used with modern, low compliance ventilators.

ANAESTHETIC CIRCUITS

Definition:

It is an assembly of hoses and components through which the patient breathes. It starts from the outlet block of the anaesthetic machine to the patient end. The circuit is