THE EVOLUTION OF ANAESTHESIA

3. THE ANAESTHETIC FACEPiece AND EARLIER MASKS

BY

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To many people the facemask is symbolic of anaesthesia and indeed it is only in comparatively recent times, with the increasing popularity of spinal and other injection methods, that anaesthetic agents have been introduced by other means. But several months were to elapse between the discovery of the anaesthetic properties of ether and the invention of the facemask for its inhalation, although very good ones were in use for gaseous inhalation fifty years before. However, since the vogue of pneumatic medicine had waned considerably in the intervening years (Slatter, 1960a) it is not surprising that in the excitement of trying out the new discovery, these masks were forgotten, the apparatus for anaesthesia being based instead on the contemporary steam inhalers and the gasbags of the recent "Frolics."

The majority of ether inhalers invented in the early weeks of 1847 utilized the long flexible breathing-tube with the "speaking-trumpet" mouthpiece of the steam inhalers and gasbags of the period. Behind the mouthpiece was a box containing cedar-wood or cork ball valves to prevent the return of expired air into the apparatus. The mouthpiece itself consisted of a central tube to be held between the lips, with a cup-shaped pad which was pressed tightly round them. Sometimes the central tube was lacking. The nostrils were pinched closed by the fingers of the administrator or by a spring clip. Natural breathing was thus made impossible and in many cases the ether vapour was inhaled only with great difficulty. Frequent failures were recorded.

_Tracy's Mouth-pad, February 1847._ One of the many inhalers exhibited at the Pharmacological Society's Meeting on January 13, 1847, was the glass apparatus of S. J. Tracy of St. Bartholomew's Hospital (1847a, d). Its only remarkable feature was its curious shape—"it bears some resemblance to a German pipe" (Tracy, 1847b) (fig. 1). In use, however, Tracy found that the valves would not act unless "the patient's head was raised and the valve-piece became perpendicular". So he separated it from the mouthpiece by inserting between them an extra piece of flexible tubing about 4 inches long. He also designed a new type of mouthpad. This was formed of "10 to 12 thicknesses of flannel and covered with morocco". It was about 5½ inches long and 4 inches wide. The mouth-tube was "screwed into the mount, over which a piece of vulcanized rubber larger than the pad with a hole in the centre is placed. The person who administers the vapour can easily press this on the patient's mouth, and compress the nose with the same." (1847c).

_Snow's Inhalers, March, April and September 1847._ Snow was always ready to make improvements to his apparatus. Figure 2 shows what may be called his Model II. Model I made at the end of January, had an ordinary mouthpiece and valve-box combined (Snow, 1847a) but for
Model II Snow (1847b) had adopted the new mouth-pad of Tracy (figs. 2, 9, 10, 11). He had also added a regulating stopcock, so that the amount of air mixed with the ether vapour might be increased or decreased at pleasure. Although they were not yet available, Snow was “now getting elastic tubes, valves and mouth-tubes, made purposely for the apparatus three-quarters of an inch in diameter”. He had discovered that great restriction to breathing was caused by the narrow inhaling-tubes and, by taking the inner diameter of the human trachea as the criterion of bore, he was able to avoid this unnecessary difficulty.

In April, Model III, “a small and very neat apparatus” to be carried in the pocket, made its appearance (Snow, 1847c). It was a smaller edition of Model II. By dispensing with the pipe surrounding the inhaler and by substituting flat for spherical valves and a ferrule for the stopcock, it could be packed into “a round leather case, such as is commonly used for holding cupping glasses”. Model IV (fig. 3) was depicted in Snow’s book published in September (1847d). The inhaler rested in a large metal box which served both as a water-bath and a container for the breathing-tube and facepiece.

Ether as an anaesthetic was quite new in 1847, though it had frequently been used in the previous century as an antispasmodic and light analgesic for the relief of headaches, tic douloureux and so on (Slatter, 1960b). In the years immediately prior to the discovery of anaesthesia these applications had been neglected; they were, however, revived to a moderate extent with the new interest in ether. Francis Sibson, surgeon at the General Hospital, Nottingham, using a somewhat modified version of Snow’s spiral inhaler, employed ether to cut short the paroxysms of facial neuralgia and allow the patient temporary relief from his pain. There was the usual difficulty in maintaining inhalation with semiconscious patients, and Sibson also had to contend with the special complication that some of his patients suffered with convulsive tic in the face,
and could not use the mouthpiece at all. On the suggestion of another surgeon of the hospital, Sibson constructed a nose-and-mouthpiece to overcome this.

Sibson's Nose-and-mouthpiece, February 1847. He bought "a common sixpenny mask" from which he cut out the septum of the nose and lips. He lined it inside with oiled silk and "pasted a funnel of Macintosh cloth over the nose and mouth, and over this a piece of Macintosh to go over the cheeks". It was held in place by a rubber strap and buckle and pressed against the nostrils with the fingers (fig. 4). He had tried it on "a remarkably lantern jawed shrivelled old man, a crying boy, on several girls", and in all cases with complete success.

This mask was used for some time by Snow, but he thought that strapping it to the head was unsafe as fresh air could not then be given quickly to a patient in an emergency. By making a mask moulded to the contours of the face and by transferring the valves from the tube on to it, Snow adapted Sibson's nose-and-mouthpiece into the prototype of the anaesthetic facemask of today.

Snow's Facepiece, June (1847d). It was made of thin sheet-lead "the pliability of which admits of its being easily adapted to the peculiar form of the features", covered with silk or glove-leather and lined with oiled silk. The central part was of brass, iron or plated copper and contained the rubber flap-valves. The expiratory valve was made "to turn on a pivot, so as to allow of the admission of external air, and to supersede the use of a ferrule or two-way tap" (fig. 5). From that time the facemask became a standard piece of anaesthetic equipment, and it is the only survivor into modern times of these early anaesthetic inhalers.

In 1774 Priestley made his "surprise" discovery of oxygen. After some preliminary tests with mice, he had the "curiosity" to breathe the gas himself. Its effect on him confirmed his belief of its "superior goodness" and he expressed the view that "pure dephlogisticated air might be very useful as a medicine" (quoted Slatter, 1960a). Within a few years the use of oxygen for treating disease had become widespread both in this country and on the Continent. François Chaussier of Dijon—"one of the most distinguished physicians of that [eighteenth] century"—taking into account the "vital" properties of the gas, concluded that a proper use of it would be for the resuscitation of infants, born in an asphyxiated condition (Dict. Encyclo. Sci. Med., 1874). It had long been the practice to attempt insufflation of the lungs in these cases, but although the idea was good, the usual means employed were not. Mouth-to-mouth inflation...
filled the lungs with vitiated and harmful expired air, while the use of household bellows was dirty. Chaussier therefore “constructed a very simple apparatus” for this purpose by means of which oxygen could be administered “with ease and safety”. It included a complete facepiece.

Chaussier’s Apparatus and Facepiece, c. 1780. The facepiece, “a sort of funnel or horn” of bladder, covered both nose and mouth (fig. 6, C).

It could easily be moulded to the features and was held on with the fingers. Adhesive plaster or a ribbon round the head of the patient were other means of keeping it on. The stop-cock was opened and oxygen squeezed from the large bladder (A) into the lungs. Chaussier (1785) had used this apparatus with good results to relieve a young man suffering from advanced consumption, but had not actually had the opportunity to try it for resuscitation. Another apparatus for the treatment of chest diseases is shown in figure 7. Oxygen was contained in the “large glass globe” (AB) submerged in the “little tub” (G) of hot or cold water. This rose up into the globe as the oxygen was breathed. The facepiece (F) of this apparatus had a soft cushioned rim.

Chaussier thought it desirable that a supply of oxygen should be kept at all Rescue Stations, and that practitioners should have it in readiness at every difficult confinement. He said: “The prudent accoucheur should prepare in advance all the means proper to the restoration of life” and particularly should he use oxygen, for Chaussier anticipated that more success would come of this than from any other method hitherto employed.

A very similar facepiece to that of Chaussier was used a few years later by Dr. Robert Menzies of Edinburgh, for his experiments on tidal volume. His dissertation De Respiratione (1790) contained “experiments made with the greatest degree of accuracy” and which “together
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with the importance of the subject” was “sufficient excuse for giving it to the public in an English dress” six years later. Menzies took up previous work on respiration and tried to copy the experiments, but finding obvious disadvantages in the old methods, he designed some new equipment for himself.

**Menzies’ Apparatus, 1790.** He took “two pretty large tubes joined together at right angles” to which he tied two allantoid membranes (fig. 8). He breathed air from E into D by means of two very light flap-valves of allantoid (fig. 9, c) which directed the flow in the tubes.

Christopher Girtanner of Göttingen, being, like Beddoes, both chemist and physician, followed the work of the latter with great interest and applied the methods himself. He made the justifiable criticisms that Beddoes’ case histories (Beddoes and Watts, 1794) were not sufficiently accurate, that he did not properly define the different kinds of consumptive diseases and that he used the many different gases indiscriminately. Girtanner selected carbonic acid gas (carbon dioxide) to treat lung diseases; its pain-killing properties were well known, and on account of its heavy weight he believed it would sink to the bottom of the lungs and not be expired again immediately. His attention had been drawn to Menzies’ apparatus as a suitable device by which the gas might be inhaled, but he found that the patients hated the strings which held it on and, as well as that, the valves were not reliable.

**Girtanner’s Inhaler and Mask, 1795.** Based on Menzies’, the apparatus (figs. 10, 11) consisted of two tubes joined at right angles to each other, containing valves. These rested on inclined seats (fig. 11, b, c). A bladder of gas was tied on at c. Girtanner pointed out that the inspiratory valve (fig. 11, c) was incorrectly drawn as it should open inwards instead of outwards. “The mask consists of a hemisphere of thin brass which is furnished with a stuffed leather pad.” It was to be pressed closely to the face and it even had an indentation for the bridge of the nose. Each apparatus was supplied with three different sizes of “mask”, so that every patient might have a well-fitting one.
Girtanner called this apparatus an "inhaler". He claimed that everybody who tried it approved of it and that experience showed it to be preferable by far to other types of apparatus. It was, in fact, the "best, most convenient and most suitable" instrument for the purpose then to be had (J. pract. Arznk., 1795).

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