CONSERVATISM has returned to dental practice. The get-rich-quick harvest from multiple extractions and replacement dentures has been reaped. With reluctance the dental surgeon views the patient whose mouth dictates extraction of teeth.

Nevertheless, it must be faced that there will always be a need for general anaesthesia for dental extractions.

I consider that nitrous oxide and oxygen, with trichlorethylene is the most generally useful choice of anaesthetic for dental extractions. My dissatisfaction with existing trichlorethylene vaporizers has prompted me to take a special interest in this problem and a "Trilene" vaporizer has been made for me which I believe has considerable merit.

Nitrous oxide, either alone or with oxygen, holds a false reputation as the anaesthetic of choice for dental extractions since Macintosh and Bannister (1943) have pointed out that, although statistics may quote a death rate of one in 50,000 administrations of nitrous oxide, they do not show how often an operation has had to be abandoned because of difficulties in maintaining the anaesthesia. Further, Clement (1951) has said that "the production of true or surgical anaesthesia with N₂O necessitates a restriction of the oxygen intake". This is contrary to all the basic principles of anaesthesia, where emphasis is rightly made on adequate oxygenation at all times.

A higher content of oxygen in the nitrous oxide and oxygen mixture is possible using trichlorethylene vapour as supplement to attain the desired level of anaesthesia. The freedom from the insidious effects of anoxia, using this technique, represents an advantage over nitrous oxide alone. This technique can be used with confidence in patients with cardiac or pulmonary disease since the additional oxygen content available benefits the heart musculature. The recovery is admittedly delayed when compared with the recovery after nitrous oxide alone, but the patient is in complete possession of all his mental faculties within five minutes; there is no feeling of nausea or vomiting and the patient can vacate the dental surgery to return home soon afterwards leaving the dental surgeon and anaesthetist with an easy mind.

The "Trilene" vaporizers in use at the present time are usually of the fluid reservoir type, incorporating a wick or baffle plate to increase the surface area of trichlorethylene available for vaporization by a flow of gases. In some models the flow of gases can be made to "bubble" through the liquid trichlorethylene and
this turbulence may even deposit liquid trichlorethylene along the lumen of the delivery tube.

It seems that existing “Trilene” vaporizers of this type were originally designed for use with ether, where the vaporization requirements are quite different. A larger volume of ether requires to be vaporized than of trichlorethylene to reach an equivalent level of anaesthesia.

Most “Trilene” vaporizers incorporate a glass bottle which has a containing capacity of from 50 ml. up to 110 ml. The breakage rate over a period of years, in both hospital and private dental practice, is appreciable. The cementing between the glass and metal or plastic components of these “Trilene” vaporizers also requires frequent attention.

I have found that 6 ml. of trichlorethylene is sufficient to cope with a resistant case, and thus a “Trilene” vaporizer charged with this comparatively small amount should prove efficient. Ostlere (1953) also states that the normal requirement for trichlorethylene is one drachm per hour.

Trichlorethylene is stable when stored in closed containers protected from light, but to avoid possible oxidation it is recommended that a fresh supply be placed in the container every few days. It is obviously bad practice to leave trichlorethylene standing in a clear, glass bottle vaporizer for more than a few days and it is obviously expensive practice to charge a vaporizer with, say 50 or 60 ml. trichlorethylene, and pour it away at the end of each day.

In my opinion the present “Trilene” vaporizers for use with gas flows are either capable of producing a sufficiently strong concentration of trichlorethylene vapour, but do not reach this concentration by a smooth gradual increase in concentration, or they produce a smooth and gradual increase in concentration, but are often not capable of producing a strong enough concentration of trichlorethylene vapour for the case in hand.

From these considerations it is obvious that trichlorethylene requires a vaporizer specifically designed to suit its own properties.
It will be seen from figures 1 and 2 that the “Trilene” vaporizer here described is of robust construction. The body is made of cast aluminium and incorporates two tubes, each to contain one 6-ml.

ampoule of trichlorethylene (fig. 1C). It will be noted there is no glass bottle container. The vaporizer is attached to the gas-oxygen machine by plugging tapered fitting (fig. 2A) into the outlet (fig. 3).

With the vaporizer control at “OFF”, gas passes directly through the vaporizer as shown by the arrows (fig. 2). With the control lever F (figs. 1 and 2) in the “MAX.” position all the gases will pass through the vaporizing chamber (fig. 2G). In any intermediate position the gases are proportionately diverted. To ensure that this is gradual, the ports have been very carefully arranged. Leakage of gas from the vaporizer through the operating spindle is prevented by a suitable sealing gland.

To charge the vaporizer, one 6-ml. ampoule of trichlorethylene is inserted into each of the tubes (fig. 1C) where they remain unbroken until required. In this
way the trichlorethylene is retained in its original closed container and protected from light and the risk of oxidation. This allows the vaporizer to stand fully charged ready for immediate use with no possibility of deterioration of the trichlorethylene.

It will also be appreciated that, for anaesthetists visiting several different dental surgeries, the space occupied in carrying ampoules is considerably less than that of a stock bottle of trichlorethylene.

The simple operation of screwing down knob (fig. 1E) will fracture the ampoule and the liquid trichlorethylene will run into the vaporizer chamber (fig. 2G) through matching holes in the tube (fig. 1C) and tube tunnel in the body of the vaporizer. The broken pieces of glass are retained in the tube.

To charge the vaporizer the ampoules are inserted as follows (the letters apply to figures 1 and 2):

1. Unscrew knob (B) fully and pull cover (D), removing tube (C) from its housing. It may be necessary to unscrew knob (E) slightly to allow full withdrawal.

2. Unscrew cover (D) from tube (C), insert one 6-ml. ampoule of trichlorethylene and replace cover (D).

3. Replace this assembly into its housing tunnel, ensuring that the tube engages with the locating pin inside.

4. Replace knob (B).

The window in cover (D) allows the contents to be checked at any time.

To operate the vaporizer, the fully charged vaporizer is connected to the outlet of the gas-oxygen machine. The chosen mixture of nitrous oxide and oxygen is presented to the patient who is asked to breathe quietly through the nosepiece presented to his nose. It is necessary to ensure that the control lever (F) is at "OFF" and then cap (E) is screwed down until the ampoule is broken. The control lever (F) is now gradually moved across the scale until the trichlorethylene, which is now being added to the gas-oxygen mixture, has the desired effect.

I find that with the lever (F) at the $\frac{1}{4}$ mark, the majority of patients can be kept at a satisfactory level of anaesthesia, with jaws relaxed, for the duration of the dental extractions. The resistant patients I have met have been controlled with the lever (F) advanced to the $\frac{3}{4}$ mark. There is thus a reserve of trichlorethylene concentration available should future patients prove more resistant.

While I have found that 6 ml. of trichlorethylene has proved more than ample for each case, there is always the ampoule in reserve to deal with an extreme demand.

At the end of each case in which I have used an ampoule of trichlorethylene I
always make a point of replacing it with a fresh ampoule at my earliest convenience.

In order to illustrate the effectiveness of this vaporizer a series of laboratory tests were carried out, using a sine pump and refractometer, at a tidal volume of 500 ml. and 16 respirations per minute.

Figure 4 shows the result of the increase in the percentage of trichlorethylene added to the gas supply as the lever is moved across the scale from “OFF” to “MAX.”. It shows the smoothness of the addition of trichlorethylene very clearly. There is no sudden rise in trichlorethylene concentration, for it is only by this smooth addition of trichlorethylene that coughing can be prevented.

Figure 5 shows the strength and duration of the trichlorethylene vapour supplement when using one ampoule (6 ml.).

The restriction to breathing was tested by measuring the volume of air passing through the vaporizer with the control lever set at the different positions with a constant input pressure of 0.5 in. water. The results were as follows:

<table>
<thead>
<tr>
<th>Valve setting</th>
<th>Flow in litres per min. at 0.5 in. water</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>60.5</td>
</tr>
<tr>
<td>¼</td>
<td>59.5</td>
</tr>
<tr>
<td>½</td>
<td>58.7</td>
</tr>
<tr>
<td>¾</td>
<td>56.4</td>
</tr>
<tr>
<td>MAX</td>
<td>53.2</td>
</tr>
</tbody>
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From the above results it is apparent that the restriction to breathing is extremely low and consistent over the range of valve settings.

My thanks are due to Messrs. Cyprane Limited, Keighley, for making this vaporizer.

REFERENCES