to which Parsloe refers and it is described correctly in at least two English books.^{3,4}

Waters¹ referred to an earlier to-and-fro carbon dioxide absorption system⁵ but he apparently chose not to include the ether drip feed into the absorber that it incorporated. However, later during World War II ether was a popular anaesthetic and a venting port at the elbow seems to have been added at that time. During induction of anaesthesia this location would have been more convenient than one at the tail of the rebreathing bag and a necessary one if bags with tails were not available. When induction was complete appropriate use could be made of a closed system. The modification can be attributed to Barnett Mallinson.^{6,7} Dr. Parsloe does us a service when he reminds us of Waters classic design though the modified version illustrated in my review to which he refers was not attributed to Waters.

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Single lever Humphrey A.D.E. low flow universal anaesthetic breathing system

To The Editor:

I read with interest the recent articles by Humphrey *et al.*^{1,2} on the single lever Humphrey A.D.E. breathing systems (parallel and co-axial systems). I commend them on their ingenuity but express some concerns. The prime objectives of any breathing system are that it be safe, simple, economical and convenient. Even the simple Bain system can be incorrectly assembled as pointed out by Humphrey *et al.*³ but undoubtedly the possibilities of hooking up any combination system incorrectly are much greater.

The Bain co-axial system can readily be tested by the Pethick test as well as visual inspection prior to its use; this is impossible with a combined system. It should be noted that utilizing flows below those recommended for the Bain system during spontaneous or controlled ventilation leads only to a modest hypercarbia. Humphrey *et al.* demonstrated this for spontaneous ventilation with a Bain system (Figure 5, p. 703).¹ The Bain system itself will never lead to hypoxia but in combined systems accidental mechanical ventilation in the "A" mode will lead not only to hypercarbia but severe hypoxia.

When we consider that only approximately 20 per cent of total anaesthetic time is with spontaneous ventilation, the economy and practicality of combined systems becomes much less. The increased cost because of the complexity of the anaesthesia machine adaptor for this system is much greater than a modest increase in fresh gas flow in the Bain system for spontaneous ventilation.

The parallel system (non co-axial) as described has no increased convenience over the circle. The co-axial system with a 28 mm diameter is bulky, particularly for children and head and neck procedures when compared to the 22 mm diameter co-axial Bain system that is suitable for all procedures and all age groups.

I would like to make a plea for simplicity. The combination systems add greatly to the complexity of our breathing systems, as pointed out by Conway⁴ and this must be weighed against any disadvantages of the non-combined systems (Magill, Bain, Jackson-Rees or circle systems).

Finally and most importantly, I would like to stress that all anaesthetists must understand fully the breathing system or systems they choose and test them for proper function prior to connection to the patient.

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REPLY

Thank you for giving us the opportunity to reply to Dr. Bain's letter. He emphasizes the criticisms which we ourselves discussed concerning the many attempts to make a combination system that is safe, simple, economical and convenient.^{1,2} However, we would like to differentiate his general comments on combination systems from the single lever Humphrey A.D.E. system discussed in our papers.^{1,2} As we were aware of the problems he mentions, the new single lever A.D.E. system was specifically designed to resolve such faults, not only in the original dual lever Humphrey A.D.E. system³ but also those in other designs.⁴ Bain's plea for simplicity has indeed been heeded, the whole mechanism of both the coaxial and parallel (non-coaxial) versions being exemplified in Figure 7 in Part II.² Conway,⁴ when he made general criticisms on the complexity of combination systems, was unaware of the simplified single lever modification of the A.D.E. system described in our papers.

To answer Bain's specific comments, leak tests described for coaxial systems such as the Lack^{6,7} are valid for the coaxial A.D.E. system. However, for simplicity we much prefer the parallel version of the system as any leaks can be detected by collapse of the reservoir bag simply by filling the system with oxygen with the lever upright, the exhaust valve closed and the patient outlet occluded. Indeed the parallel version provides a solution to the plea for a system that avoids the problems of kinking, twisting or disconnection of the inner tube reported with the Bain system.⁸ In addition, connecting the two separate tubes of the parallel version is as simple as that with the standard circle absorber. Neither the coaxial nor the parallel version of the A.D.E. system (both use the same main body) can be accidentally left in the "A" mode during mechanical ventilation, a dangerous possibility already described by Humphrey⁴ that can occur with most alternative combination systems.

It may well be that in Bain's experience that only 20 per cent of his anaesthesia hours are with spontaneous respiration. The ratio differs substantially from centre to centre, our experience from other countries being that the percentage is much higher. However, since almost all patients breathe spontaneously at the beginning and end of anaesthesia, the appropriate apparatus is required especially during the critical potentially hypoxic phase when spontaneous respiration is being re-established. We re-emphasize that the switch between spontaneous and controlled ventilation with the single lever A.D.E. system involves only the appropriate positioning of the lever without further adjustment. We have contrasted this to the Bain system in which the ventilator and reservoir bag require interchanging while the valve and fresh gas flow need adjustment.² We have also pointed out that the A.D.E. system is always ready for manual ventilation even when the ventilator is connected and in use. In an emergency (such as ventilator failure), the ventilator can simply be switched out of circuit; this action automatically puts the system into the manual mode. Again this is not possible with the Bain system. Hence we feel that the system is, in fact, simpler and safer to use than the Bain system and of particular

benefit to the occasional anaesthetist, realizing that, worldwide, the majority of anaesthetics are not given by specialist anaesthetists.

With regards to economy, Bain dismisses the savings that can be achieved. However, we calculate that the saving of anaesthetic gas will pay for the A.D.E. system in about two to eight months, depending on the anaesthetic hours and the local cost of anaesthetic gases and vapours (with isoflurane the time scale is much reduced). The reduction of the potential for theatre pollution at source and the increased natural humidification within the system during spontaneous respiration has added advantage.

Bain's observation that the A.D.E. system has no increased advantage over the circle needs clarification. With the fresh gas flows of 4-5 L·min⁻¹ commonly used with the circle system,⁹ we feel that there is little point in recycling anaesthetic gases through bulky circle absorber apparatus when such flows would generally be adequate with the A.D.E. system. The A.D.E. system avoids the well-known problems of the circle absorber and ensures that the patient is breathing the dialled concentration of anaesthetic gases and vapours. Soda lime can be dispensed with altogether. These are distinct advantages. Bain also introduces the problem of using the coaxial A.D.E. system with 28 mm diameter tubing in children. The latter was outside the scope of our papers which were confined to adult studies. Papers regarding our observations in children are being prepared, though these have already been abstracted.¹⁰ Nevertheless, while similar advantages were observed as for adults, we found it convenient to use the parallel system in children with 15 mm diameter tubing 1.5 metres long. Such tubing, weighing only 90 gm at the patient's face, is lighter than many commercially available T-piece and Bain systems. Indeed, on finding that the resistance to flow through 15 mm tubing was much the same as through Bain or Lack tubing and that function was unaffected, we now use 15 mm diameter tubing for adult patients as well as children, making one size of tubing advantageous in all age groups.

In conclusion we endorse Bain's final comments that all anaesthetists must understand and test the breathing system they select. Anaesthetists must of necessity be particularly cautious with new equipment. However, there is now sufficient independent evidence that the Humphrey A.D.E. system functions as efficiently and safely as was originally claimed. While favourable comment has already been made,¹¹ general acceptance of the system will only become possible after further practical assessment by anaesthetists themselves in both academic and rural environments.

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Para-tracheal Audible Respiratory Monitor (PTARM)

To the Editor:

The use of a precordial or oesophageal stethoscope to monitor breath sounds during anaesthesia is an established method for detecting failure of ventilation due to any cause. However, the need for the anaesthetist to be connected to the stethoscope tubing can interfere with the performance of other anaesthetic duties.

We have found the Para-Tracheal Audible Respiratory Monitor (PTARM) to be more informative than precordial or oesophageal stethoscopes in the early detection of respiratory obstruction or depression. PTARM is especially valuable in the CT scan room, the intraoperative irradiation room or any other location where the anaesthetist is of necessity forced to remain at some distance from the patient. It can also be used to monitor the patient's breathing in the Recovery Room. This device frees the anaesthetist from the earpiece and connecting tubing that limit movements about the patient. It also allows all anaesthesia personnel in the room to monitor the patient's breath sounds simultaneously.

FIGURE Lateral (right) and frontal (left) view of microphone and its holder.

The PTARM is comprised of a condenser microphone (Sony, Japan, Model 0604), plus a preamplifier, an audio-amplifier and a loudspeaker. The preamplifier and audio-amplifier are both included in a consumer's audio-kit (Decad Electronics, Tel Aviv, Israel) which uses a 2N5089 transistor and a TDA 2003C audio-amplifier chip (Fairchild Camera & Instrument, Mountain View, California)). We have used a three-inch loudspeaker.

The holder and the flexible band (Figure) were designed for convenience of use when applied for long durations.

The PTARM can be used as a respiratory monitor in any anaesthetized patient breathing spontaneously or ventilated through an endotracheal tube. The broadcast of the audible sounds of air movement allows the anaesthetist to continuously monitor ventilation, without the disadvantage of the physical restrictions imposed by precordial or oesophageal stethoscopes.

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Anaesthesia for Treacher Collins Syndrome

To the Editor:

I read with interest the article "Anaesthesia for Treacher Collins and Pierre Robin Syndromes: a report of three cases" by Rasch *et al.*¹ I have had extensive experience