

## Further electronic evolution of the Palmer Kymograph

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Canon & Mulvihill (1975) demonstrated how the Palmer Kymograph together with a George Washington recorder and an overhead projector could be assembled as one unit, including a high-gain pre-amplifier. We have been gradually converting our obsolescent Palmer Kymographs into polygraphs

with a rack carrying four pre-amplifiers and associated stabilized power supply points. A unit with a total of eight channels is now shown. Its cost is approximately a fraction of that of an equivalent modern commercial multi-channel recorder.

The use and cost-benefit of polythene roll tracings has already been referred to in the earlier 1975 report.

## Reference

CANNON, P.J. & MULVIHILL, T. (1975). Adaptation of the George Washington (G.W.) pen-recorder for overhead projection. *J. Physiol., Lond.*, **250**, 6P.

## Transducer—adapted Benedict Roth Spirometer for small animals

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The dearth of simple satisfactory teaching experiments involving, for example, oxygen consumption,

heart rate, movement, etc., in cats, dogs or rabbits is well known.

The animal is placed in a clear glass box, approximately  $50 \times 40 \times 40 \text{ cm}^3$ , i.e. 80 litres (which can be covered over by dark polythene). See Figure 1. The box is connected, as a human subject would be connected, by inspiratory and expiratory tubing to a Benedict Roth Spirometer. The gasses in the box are mixed by means of a circulating fan system. Jacketed

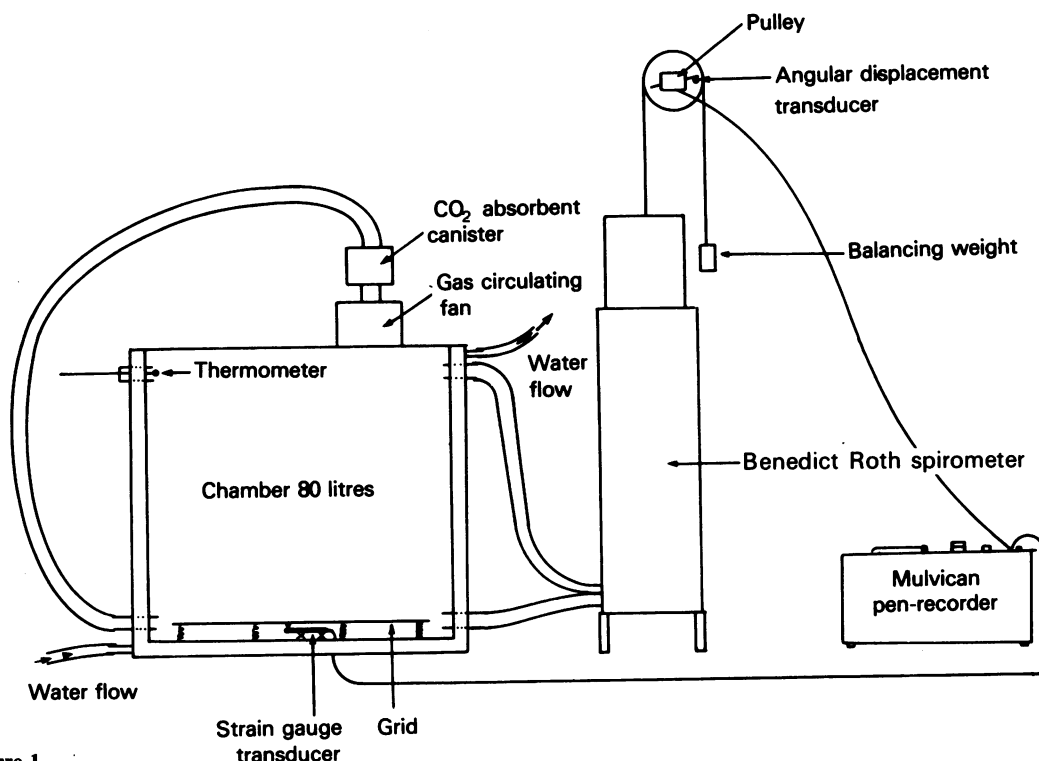


Figure 1

water is kept at more or less constant temperature by adding tap water at a rate of 500 ml/minute. Carbon dioxide absorbent is placed in series with the circulating system and 'sits' on top of the circulating fan. The colour of the absorbent is easily checked by viewing through a window in the container (a factor not possessed by the original Benedict Roth).

The Benedict Roth spirometer and Washington or other pen-recorder are connected to a transducer. The associated continuously variable amplification of the electrical analogue is adjusted to give a tracing on the chart paper conveniently making an angle of about 45° with the horizontal, and based on a degree of amplification corresponding to 45 ml O<sub>2</sub> (STP)/cm.

A higher amplification readily reveals the animal's respiratory movements.

In addition, the tracing shows changes in the physical activity of the animals. The grid 'sits' on springs which help to register movements, which are conveyed to a strain gauge transducer and are 'effectively' integrated.

Among the drugs demonstrating interesting information are amphetamine and triiodothyronine. The ECG can be readily telemetered and conveyed to a further channel.

The effects of aspirin poisoning, volatile general anaesthetics and many other agents may be usefully studied by this method.

The effects on oxygen consumption, activity and heart rate of groups of small animals (rats, mice, etc.) placed in a box at the same time can also be studied.

The 'Mulvican' overhead projector recorder (Cannon & Mulvihill, 1975) is shown in use here. The light is incidentally much greater than that obtained by using an episcope (Baker, 1975).

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## References

- BAKER, J.B.E. (1975). The episcope for large screen projection of tracings on opaque media during their recording for demonstrations. *Br. J. Pharmac.*, **56**, 396P.
- CANNON, P.J. & MULVIHILL, T. (1975). Adaptation of the George Washington (G.W.) pen-recorder for overhead projection. *J. Physiol., Lond.*, **250**, 6P.