Rochester and Martin implied that I merely "suggested" a method. However, a specific method which had already been put into practice was described, and its merits were illustrated by results which had been obtained.

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[1] Rochester, G. C. O., and Martin, A. E., *Nature*, **168**, 785 (1951).
[2] Walsh, A., *Nature*, **167**, 810 (1951).
[3] *Perkin–Elmer Instrument News*, **1**, No. 4, 3 (1950).

A Quadruple Monochromator

IN previous communications[1–3], the principle of a method for converting a single monochromator into a multiple monochromator and the application of this principle to the construction of double monochromators were described. An infra-red spectrometer constructed on this principle showed a considerable improvement over a single monochromator. A quadruple monochromator has now been constructed on the same principle, and our experience indicates that the construction of higher-order monochromators will not be unduly difficult.

In Fig. 1, S_1 is the entrance, and S_2 the exit, slit of a typical monochromator. When used in the conventional manner, radiation passing through S_1 falls on the dispersing system and radiation of wave-length λ_1 passes through the exit slit S_2. By placing two mirrors M_3M_4 at right-angles to each other and with their apex on S_1, radiation of another wave-length λ_2 falls on M_3M_4, and returns once more through the dispersing system before passing through the exit slit S_2. Similarly, radiation of wave-length λ_n will undergo n dispersions before passing through the exit slit. Thus, for one position of the dispersing system, radiation of several different wave-lengths falls on the exit slit. Suppose it is desired to isolate radiation of a given order, for example, the fourth. Referring to Fig. 1, this is achieved by arranging a small chopper in such a manner that it interrupts, at a given frequency, radiation of the fourth order at the position where it first strikes the mirror M_3, that is, at A. It is simple to ensure that radiation

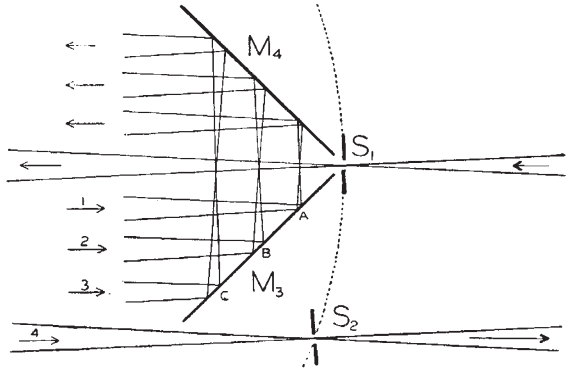

Fig. 1. Diagram illustrating method for converting a single to a quadruple monochromator

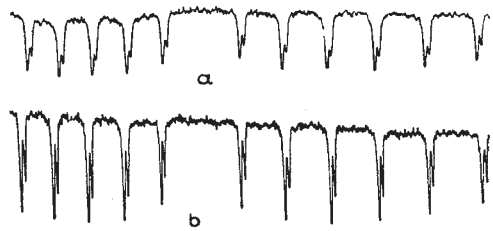

Fig. 2. 3·5-μ band of hydrogen chloride obtained with (*a*) a double and (*b*) a quadruple monochromator. Lithium fluoride prism

of any other order cannot be chopped and pass through the exit slit. The curvature of the slits of the conventional monochromator must be modified to accommodate the increased image-curvature of the fourth order. By passing the signal from the detector to an amplifier tuned to the same frequency as the chopper, only the fourth-order radiation produces an output signal.

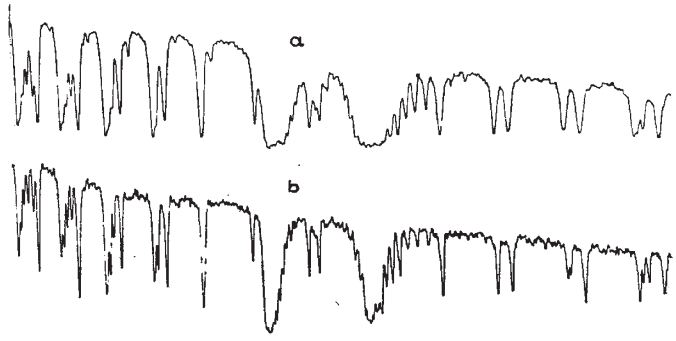

Fig. 3. 10-μ band of ammonia obtained with (*a*) a double and (*b*) a quadruple monochromator. Sodium chloride prism

A Perkin–Elmer infra-red spectrometer (Model 12*C*) has been converted to a quadruple monochromator by the method described above. Typical spectra are shown in Figs. 2 and 3. Fig. 2 shows the 3·46-μ band of hydrogen chloride taken on the double and quadruple monochromators using a lithium fluoride prism. The isotope lines (separation 2·0 cm.$^{-1}$) cannot be resolved with the single monochromator. Fig. 3 shows the 10-μ band of ammonia obtained with the double and quadruple monochromators using a sodium chloride prism. Spectra have also been obtained using calcium fluoride and potassium bromide prisms, and resolutions obtained of the order of 0·25 cm.$^{-1}$ (6-μ water-vapour band) and 0·8 cm.$^{-1}$ (at 520 cm.$^{-1}$ in the rotational water-vapour band) respectively. As in the double monochromator, the amount of scattered radiation is too small to be detected.

A fuller discussion of the design and performance of the quadruple monochromator will be published shortly.

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[1] Walsh, A., *Nature*, **167**, 810 (1951).
[2,3] Walsh, A., *J. Opt. Soc. Amer.* [Feb. 1952].