reduce the noise resultant from the high gain, the instrument response time must be increased and scanning speed must be reduced to permit following the spectral structure. With the scanning speed so set, the instrument is operating inefficiently in the regions of high solvent transmission, since it is running more slowly than necessary.

The same situation holds in the Beckman. With a certain resolution desired at the bottom of a solvent band, the energy available is fixed and, therefore, the signal value by which the slit program is determined. In regions of high solvent transmission the slit must narrow to maintain this constant. Since scanning rate is a function of slit width, the instrument will scan more slowly than necessary through the latter regions, although spectral resolution would be increased.

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Comments on "Principles of Infrared Spectrophotometry"

VAN ZANDT WILLIAMS very kindly submitted a draft of his paper to us for comment prior to publication. Although in many respects we have come to full agreement with Dr. Williams, and we appreciate and respect his sincere effort to present a judicial consideration of the instrument problem, there remain certain irreconcilable differences in point of view between us.

One such issue concerns the respective time and noise efficiencies of the instrumental systems. A spectrophotometer is used to collect data. Whether these data are truly "per cent transmission" can only be determined by making a standardizing run as well as a sample scan, as Dr. Williams recognizes in his discussion of the sampling problem. The true per cent transmission is the quotient of these independent values, hence "noise" in both runs contributes to errors in actual values of per cent transmission. Furthermore, to be accurate, data must include matching corrections. These considerations are valid for any spectrophotometric system used in any wavelength region. In the infrared, however, they are of unusual importance, because of the magnitude of the noise problem and the impermanence of common optical materials.

The distinctions between systems A and B in respect to noise and recording time are therefore these: records made with system B do not contain the standardizing information and, consequently, may have lower noise, but they represent per cent transmission only approximately. System A provides a slightly "noisier," but direct-reading, record. Any method that can be proposed for modifying system B to provide actual per cent transmission records increases its noise level. Also, in principle, to obtain equally reliable per cent transmission data with either system, the same number of scans is required. The application of these ideas to the other systems is obvious.

The problems of amplifier linearity and stability and of source stability are admittedly important for system A. We feel, however, that even greater emphasis should be placed on the alternative difficulties encountered in system B in obtaining linearity and achromatism of the beam attenuator. We also feel that it is relevant to point out that the required high order of amplifier stability and linearity and of source stability can be obtained by straightforward application of recognized techniques in electronic engineering. Fortunately, stability and linearity need not depend upon nice mechanical adjustment or perfection of construction of components, but may be inherent in design. The validity of these statements has been tested in a commercial infrared spectrophotometer for almost five years.

Another significant distinction between system A and those remaining is that the former requires far more precise control of monochromator temperature, in order to achieve the extreme wavelength stability needed to retain compensation of sharp background absorption bands at high resolution. Experience has shown that this difference is of considerably greater importance than most of those formerly emphasized.

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