Institute of Gas Technology's P-V-T apparatus diagrammed in Figure 2.

CEP review

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Techniques for P-V-T measurements

Uses of experimental P-V-T composition data are reviewed briefly to show the need for increased accuracy in new data.

"*It is an inescapable fact that in research, the quality of a conclusion is expressable in terms of one or more measurements. Without such a reduction to elementary considerations, no experiment is repeatable, no result is verifiable—no basis exists for the entire structure.*"

This statement (*1*) is especially true for our field—chemical engineering. In recent years, it has also become increasingly evident that measurements of a given accuracy have a definite place in time in the development of a given area of physical science. As theoretical and empirical methods of representing behavior are improved and come abreast of data accuracy, it may be pertinent to inquire as to whether an addition to the literature represents new information or measurement error. Frequently an increase in the accuracy of experimental data may be necessary to implement the next step in theoretical or analytical developments. Such steps have frequently characterized developments in the field of physics.

Those working on the *P-V-T* behavior of fluids should seek such improvements. Re-examination of their approach might be worthwhile for many university and industrial laboratories. It would seem that many investigators overlook the uses that others will try to make of their data after they become part of the literature—even though the investigator may have stated intended limits of use. In many cases, in considering service to the profession, it might be worth the extra effort to improve a piece of apparatus to the point that another significant figure can be added to the values reported. It might be worthwhile for more university laboratories to emulate the practice of a noted laboratory in Europe. In this, the number of apparatus construction activities is reduced to a minimum; a single apparatus is built and it is as refined as possible. In this approach, masters degree candidates would engage in fewer apparatus construction activities; more would spend their time on taking high quality data, data analysis, and carrying out calculations with these data. It might also be hoped that the more mature investigators in industrial laboratories would seek to add all possible refinement to their efforts. In short, this is a plea for excellence in the *P-V-T* investigations that may be planned in the future.

Such a plea requires defense because it would certainly mean reduction in the number of thesis investigations of intermediate sophistication—those with the objective of building a piece of equipment and obtaining some data primarily for experience. A generation ago, densities of little better than two-figure accuracy provided the level of information on fluid behavior generally necessary. Since then, equations of state and other methods of representation have been improved to the point that data of such accuracy now seldom add much to the useful information in the field. The requirements for modern equation of state development, second and third interaction virial coefficient determination, and phase equilibrium prediction work are such that accuracies in excess of four significant figures are frequently worthwhile. At times this may require expensive duplication of work done not too many years before unless the earlier investigator is quite foresighted. A further impetus for internally consistent liquid, gas, and dense fluid *P-V-T* work is provided by the success which has been realized in representing nonequilibrium (transport)